ESPRIT III™

COLOR

VIDEO DISPLAY TERMINAL
REFERENCE MANUAL

MRA003
MAY 1983

SAFETY SUMMARY

WARNING

Dangerous voltages (23,000 vdc, and 100 to 240 vac) are present in the Video Display Terminal. Some voltage may remain present in monitor circuits after power is removed. Use caution when working on internal circuits. Do not work alone.

The terminal power cord should always be unplugged before the cover is removed. Use caution when handling the cathode-ray tube (e.g., wear safety goggles) to avoid risk of implosion. The internal phosphor coating is toxic; if the tube breaks and skin or eyes are exposed to phosphor, rinse with water immediately and consult a physician.

WARNING

This equipment generates and uses radio frequency energy and if not installed and used properly, i.e., in strict accordance with the instruction manual, may cause harmful interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device, pursuant to subpart J of part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment.

Operation of this equipment in a residential area is likely to cause interference, in which case the user, at his own expense, will be required to take whatever measures may be required to correct the interference.

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Section I

INTRODUCTION AND DESCRIPTION

1.1 INTRODUCTION

The Esprit III Color Terminal combines large-scale integrated circuit and microprocessor technologies to provide maximum flexibility and the most wanted features in an economical terminal with the following capabilities:

- Video attributes, dual intensity and line drawing graphics permit extensive screen formatting and visual effects.
- Smooth scroll, multi-page memory (option), screen freeze and buffered printing facilitate use for data base access.
- Protected fields, split screen with line lock, field tab, selective clear commands and selective transmission with programmable field, line and message delimiters simplify form fill applications.
- Local editing features include insert/delete line, insert/delete character in line or in page, and full cursor controls.
- Down loadable function keys which may be programmed to transmit only, operate locally only, or both, permit maximum flexibility for special applications.
- Programmable edit key operation, data compression and transmission modes permit optimum utilization of communication channels.
- Features and remote command set are compatible with the monochrome Esprit III and TeleVideo 950[1] terminals.
- It can act as a line monitor, displaying all 128 ASCII characters including control codes.

This manual describes the features and characteristics of the Esprit III Color Terminal:

- Installation, setup and turn-on instructions are in Section II.
- Data for operators, describing keyboard functions and modes of operation is in Section III.
- Data for programmers, describing the many remote commands is in Section IV.
- Interface details for installation planning are in Section V.

Technical assistance or additional information may be obtained from:

ESPRIT SYSTEMS INC.
100 Marcus Drive
Melville, NY 11747

1.2 DESCRIPTION

The Esprit III color terminal includes a high resolution color CRT video monitor, a detached keyboard with its own microprocessor to scan the keys, and two serial input/output ports. The technical characteristics of the terminal are summarized in Table 1-1.

Table 1-1. Technical Characteristics (Sheet 1 of 2)

DISPLAY FORMAT	
Screen	13-¼ inch (335 mm) diagonal, P22 phosphor, raster refresh, 8 independently controlled foreground colors with 8 switch selectable background colors.
Capacity	80 characters/line × 24 lines (1920 characters) plus 25th status/message line.
Character Format	7 × 9 dot matrix in 9 × 12 window, dual intensity. Character shows through cursor in reverse video when superimposed.

[1]Trademark of TeleVideo Systems, Inc.

Table 1-1. Technical Characteristics (Sheet 2 of 2)

Cursor	Block or underline; steady, slow or fast blink (keyboard selectable).
Character Set	128 ASCII characters plus 15 line drawing graphics.
Refresh Rate	60 Hz or 50 Hz, no interlace.
INTERFACE	
Input/Output	EIA Standard RS 232 or 20 mA current loop at 50, 75, 110, 135, 150, 300, 600, 1200, 1800, 2400, 3600, 4800, 7200, 9600 or 19,200 baud, switch selectable.
Auxiliary I/O	RS 232 with keyboard or remote output enable/disable. Buffered output independent of main port baud rate, or bidirectional
Parity	Odd, Even, One (Mark), Zero (Space), or None switch selectable.
Character	Start bit, 7 or 8 bit word, parity, minimum of 1 or 2 stop bits.
Modes	Half or full duplex, interactive or batch
PHYSICAL/ENVIRONMENTAL DATA	
Dimensions	Console: 14.5″ (368 mm) H, 17.3″ (440 mm) W, 15.5″ (395 mm) D, 33 lbs (15 kg) Keyboard: 2.6″ (66 mm) H, 17.3″ (440 mm) W, 7″ (180 mm) D, 3.5 lbs (1.6 kg).
Power	115 or 230 V, 50 or 60 Hz, 70 watts (238 btu/hr)
Environment	Operating: 10°, to 40°C (50° to 104°F), humidity 5% to 95% non-condensing. Storage: 0° to 65°C (32° to 150°F)
ADDITIONAL FEATURES	
Keyboard	Detached typamatic keyboard with 14 key numeric pad. Key click selected or cancelled from keyboard.
Self Test	Automatic memory test at turn-on with specific fault indications plus keyboard entered video and input/output tests.
OPTION	
Multipage Memory	48-, 72-, or 96-line display memory may be organized as 24-, 48-, or 96-line pages.

SECTION II

INSTALLATION, SETUP AND TURN-ON

2.1 INSTALLATION

2.1.1 Voltage Setting. After unpacking the terminal, check that it is set for the proper mains voltage. A slide switch on the bottom of the display console selects either 115 or 230 volt operation. To change the selection, remove the screw holding the security link, change the switch setting, and replace the security link on the other side of the switch.

The terminal is normally shipped with a U.S. standard 115 VAC power plug. For other power sources this may have to be changed. If so, replace the plug with an "Eagle" type 6–15P plug or equivalent Underwriters Laboratory listed device. The brown wire is the "hot" lead and the blue wire is neutral. **Make sure the green lead is securely connected to the ground terminal of the new plug.** This may already have been done by your dealer or distributor.

2.1.2 Keyboard Connection. To connect the keyboard to the display console, orient the connector so that the small tab is toward the front of the terminal, and press the connector into the mating jack at the bottom right side (figure 2–1) until it latches in place.

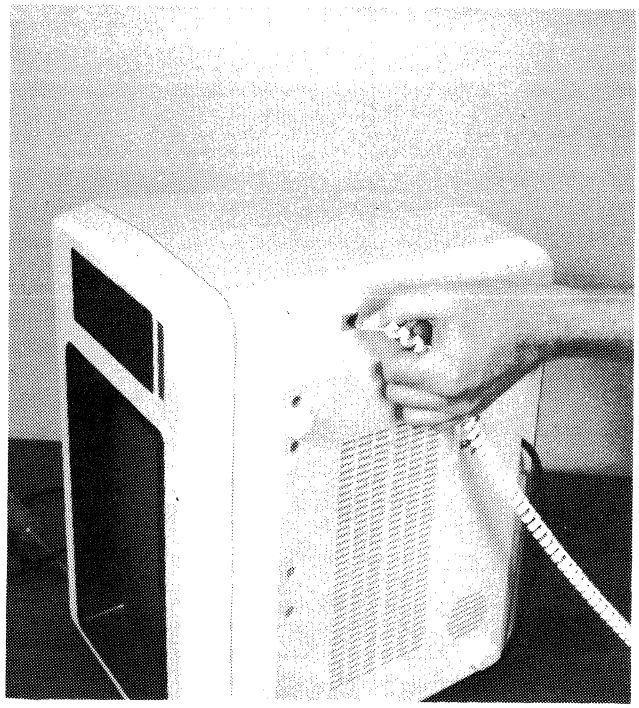

Figure 2–1. Keyboard Connection

2.1.3 Input/Output Connections. The two EIA standard RS 232 serial I/O connectors are located at the rear of the terminal. Connect the host computer, directly or through a data set, to the "EIA/CL" connector. A serial peripheral device, such as a printer, may be connected to the "PRINTER EIA" connector.

Interface details are provided in Section V.

2.2 SETUP

Two banks of ten switches at the rear of the terminal (figure 2–2) are used to select communications, operation and display options. Extra copies of figure 2–2 are included at the rear of this manual. It is recommended that normal switch settings be noted and a copy kept near the terminal.

Note

Switch selections determine the terminals operating characteristics **at power turn on** only. Most can be overridden by remote command or by the keyboard setup mode. **Changing a switch setting after power is on will have no effect.**

Bank 1 switch 1 selects the display **refresh rate,** and should normally be ON (60 Hz). However, if the local power frequency is 50 Hz, interference from nearby equipment may cause wavyness in the display. In this case, a better display may be obtained by setting this switch to off (50 Hz).

Setting switch 2 ON selects **reverse video** over the entire screen area. The standard display will be dark characters on a light green background. With normal video selected the display will be light green characters on a dark background.

Switches 3, 4 and 5 must be set to select a **parity** mode compatible with the system the terminal is connected to:

- None — If switch 5 is ON, no parity bit will be transmitted by the terminal, and no parity check will be made on received data. The setting of switches 3 and 4 is immaterial in this case.

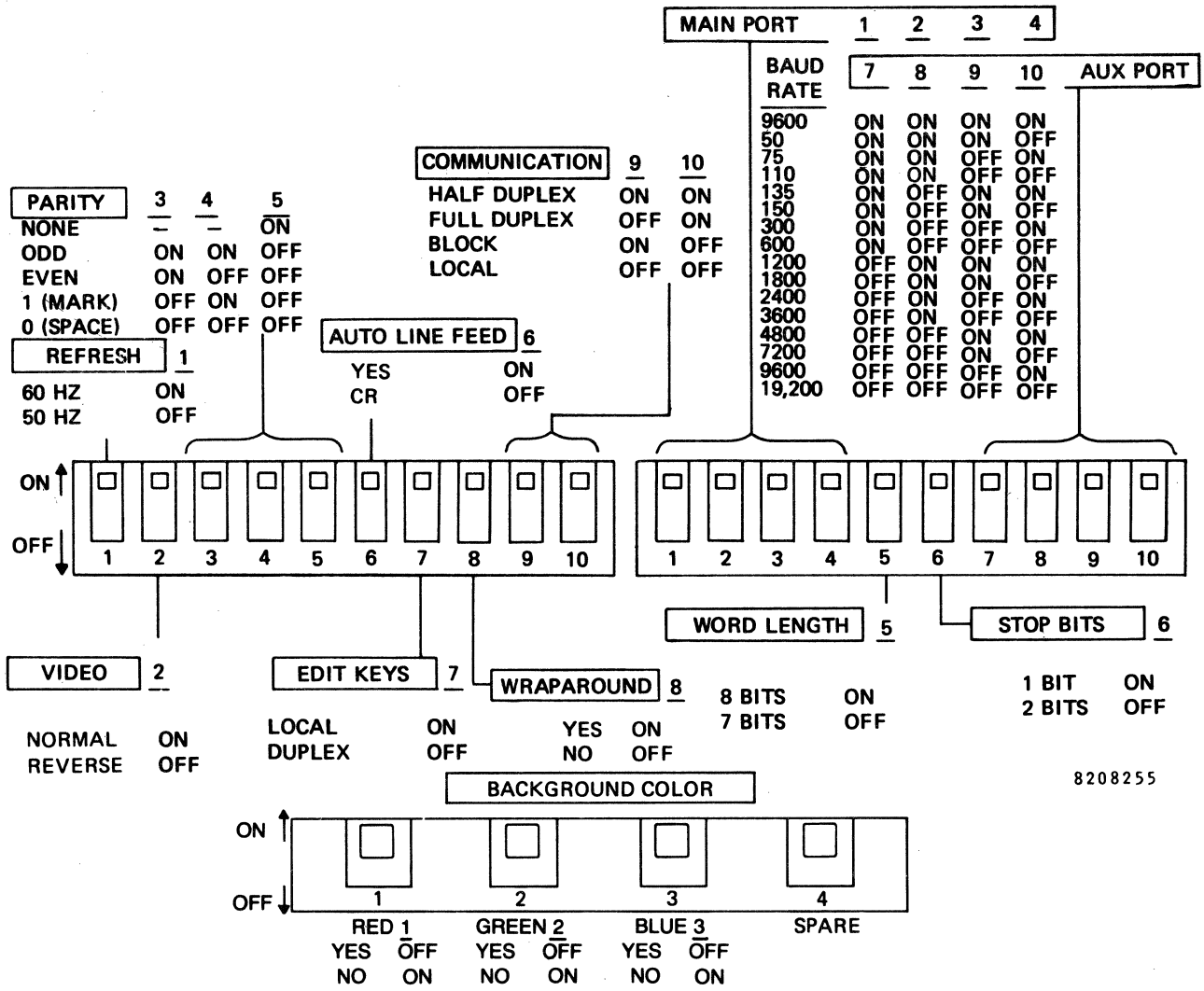

Figure 2–2. Switch Selections at Rear of Terminal

- Odd or Even — A parity bit will be added to each character transmitted to make odd or even parity as selected. Each received character will be checked for the corresponding parity, and an (a) symbol displayed if there is an error.

- 1 or 0 — The parity bit in transmitted data will always be a 1 (mark) or 0 (space) as selected. No parity check will be made on received data.

Switch 6 is used to select **auto line feed.** When enabled, each carriage return causes the terminal to perform a line feed also (new line) eliminating the need to type both RETURN and LF. Line feeds are ignored. If this switch is off, carriage returns move the cursor to the start of the present line, and line feeds move it down. If the display is consistently double spaced this switch should be set to off as the computer is taking care of auto line feed.

Switch 7 is used to select whether or not the **edit keys transmit.** When local is selected, the cursor movement, TAB, all INSERT and DELETE keys, the CLR and ERASE keys, PRINT and SEND keys cause the appropriate action at the terminal but nothing is transmitted to the host computer. When "duplex edit" is selected, the command sequence corresponding to these keys is transmitted to the host, permitting the computer to keep track of the status of the display.

Switch 8 is used to select automatic **horizontal wraparound.** When ON, if the cursor writes a character in the 80th column, it automatically moves to

the first column of the next available line. If this feature is off and the cursor is in the 80th column it will remain there, overwriting old data with new, until a cursor movement command is received.

Switches 9 and 10 select the **communication** mode. If half duplex is selected, each keyboard entry will be both transmitted (except cursor and edit keys if "local edit keys" has been selected) and acted on by the terminal. If full duplex is selected, the terminal transmits each keyboard entry and expects the character(s) to be echoed back by the host computer. Only the characters recieved from the computer are acted on by the terminal (again, local edit is an exception). If block mode is selected, keyboard entered data is stored in display memory but not transmitted until the SEND key is pressed or a remote command to transmit is received. If local is selected the terminal will operate as in block mode but the SEND key and received data will be ignored. All communication with the host computer is cut off.

Bank 2 switches 1 through 4 are used to select one of fifteen **baud rates** for the **main port** (used to communicate with the host computer).

Switch 5 is used to select the **word length** for the characters transmitted by the terminal. The first 7 bits are always the 7-bit ASCII code. If an 8-bit word is selected, the eighth bit will always be 0.

Switch 6 is used to select the minimum number of **stop bits** the terminal will insert between the end of one character and the start of the following character.

Note

If an 8-bit word plus a parity bit is selected, only one stop bit is inserted regardless of the setting of this switch.

Switches 7 through 10 select one of fifteen **baud rates** for the **auxiliary port** (used to send to a printer or other auxiliary device).

The third bank of four switches selects the **background color.** This selection determines the screen color when no characters are displayed, as follows:

COLOR	S1	S2	S3
Black	On	On	On
Red	Off	On	On
Green	On	Off	On
Blue	On	On	Off
Yellow	Off	Off	On
Cyan	On	Off	Off
Magenta	Off	On	Off
White	Off	Off	Off

S4 in this bank is not used.

2.3 TURN-ON AND SELF TEST

a. Place the terminal in the desired work area. Insure that air can circulate freely around the rear, base and top of the display console.

b. Plug the power cord into a properly grounded outlet. Do not use adapters that prevent the terminal from being properly grounded or a shock hazard may result.

c. Set the power switch at the rear of the terminal to ON. The terminal should sound a short beep and the red LED on the keyboard should come on. The terminal will automatically perform a **memory test** at this point. After a brief warmup, the steady block cursor should appear at the home position and the status line should be displayed with no error message. If the display fails to come on or Err1, Err2 or Err3 is displayed on the status line, set the power switch to off, wait 30 seconds, and set the power switch to ON again. If the fault recurs, the terminal is defective.

d. Terminal features not controlled by the DIP switches may be set up at this time as described in paragraph 3.2.6

2.3.1 Video and I/O Self Test. Two additional tests may be performed at this time if desired.

a. Self Test 1 checks the character generator and video attribute circuits of the terminal. Press SHIFT and SET UP simultaneously. The cursor should move to the middle of the status line. Press 1 and the test pattern should appear. The test pattern consists of the following, in order:

- The full 128 character ASCII set in high intensity (NUL displays as space)
- Fifteen graphics characters
- Ninety six displayable ASCII characters in half intensity
- Sixteen rows of 79 ASCII characters (0 through ~) with each color and color combination in normal and reverse video. The two rows which correspond to the background color selection (paragraph 2.2) will appear as blank.

b. Self Test 2 checks the main and auxiliary port input/output and requires a jumper cable as shown in figure 2-3.

NOTE

If your terminal is normally connected to an RS 232 type modem or acoustic coupler, that cable probably has the needed connections. Disconnect if from the modem and attach the connector normally connected to the modem to the PRINTER connector on the terminal.

DB25P CONNECTORS OR EQUIVALENT

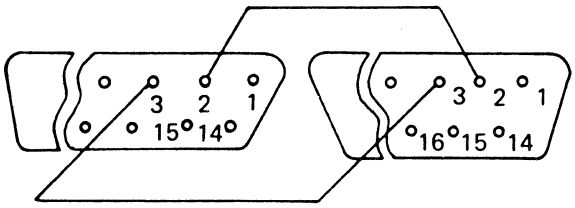

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Figure 2-3. I/O Self Test Jumper Cable

1. Set the power switch to off and connect the jumper cable between the "EIA/CL" and "PRINTER EIA" connectors at the rear of the terminal. Note the setting of the last four switches at the rear of the terminal (AUX Port Baud Rate)

2. Set the power switch to on and after the cursor appears, type SHIFT/SET UP. The cursor should move to the middle of the status line.

3. If the main port Baud rate (indicated at end of status line) is not the same as the aux port Baud rate noted in step 1, depress → until the cursor is over the BAUD rate field, and then depress t until the main port Baud rate is the same as the aux port.

4. Press 2. The terminal will run four I/O tests as follows:

- Transmits a pattern of 1 0 1 0...from the main port and verifies that it is received at the aux port (test 1).
- Same with a pattern of 0 1 0 1...(test 2).
- Transmit a pattern of 1 0 1 0...from the aux port and verifies that it is received at the main port (test 3).
- Same with a pattern of 0 1 0 1...(test 4).

PASS should be displayed. A failure is indicated by FAIL and the test number.

2.4 USER MAINTENANCE

WARNING

Repair or adjustment of internal components should be performed only by a qualified technician.

Dangerous voltages (23,000 VDC, and 100 to 240 VAC) are present in the terminal. Some voltage may remain present after power is disconnected.

The internal phosphor coating on the cathode ray tube is toxic; if skin or eyes are exposed to phosphor due to a broken tube, rinse with water immediately and consult a physician.

2.4.1 Troubleshooting. If the unit fails to turn on (beep does not sound and red LED on keyboard does not light) check the following:

- Power cord connected to a working outlet and power switch on
- Fuse not blown.

The fuse holder is at the bottom rear of the terminal. Use only a 2.5A, 250 V type 3AG fuse. Use of a higher rated fuse may cause damage to the terminal.

If the unit comes on with no error message but fails to operate properly, check the following:

- Connectors at rear of terminal are tight
- DIP switches at rear of terminal are set properly for the system
- CONTRAST control at rear of terminal is set properly
- If possible, substitute another terminal to insure that the problem is not in the interface

If the terminal appears to operate locally but does not communicate, perform the I/O test (para. 2.3.1 b). If it passes this test, the fault is probably not in the terminal.

2.4.2 Cleaning. The exterior of the terminal may be cleaned by wiping it with a damp cloth. The CRT face may be cleaned with a household glass cleaner.

SECTION III

OPERATION

3.1 DISPLAY ORGANIZATION AND SETUP MODE

3.1.1 INTRODUCTION. At power turn on, the Esprit III terminal will display a steady block cursor in the home position and a status line at the bottom (25th row) of the display in reverse video. The status line will display the cursor row and column number, most of the operating modes selected by the switches at the rear of the terminal (paragraph 2.2), and possibly an error message. The status line and use of the setup mode to change operating mode selections is described in the following paragraph. Display will be organized as one to four 24-line pages depending on the amount of memory installed. This is described in more detail in paragraph 3.1.3.

3.1.2 Status Line and Setup Mode. The following information is displayed on the status line from left to right.

PRC=prrcc The page number (0 to 3), row number (01 to 96) and column number (01 to 80) of the current cursor position.

TBSY Terminal Busy—The terminal's input buffer has filled beyond 90% of capacity. If the host computer responds to an XOFF (DC3 character) by suspending transmission, the terminal will have automatically caused it to do so. If the host does not respond or this feature has been disabled, some data has probably been lost.

Err1, Err2 or **Err3** Indicates the terminal has detected a memory fault during power up self test (paragraph 2.3).

PBSY Printer Busy—The device connected to the auxiliary port is indicating it is not ready.

PRT# or **BDIR** Current status of the auxiliary port (figure 3–5).

MONT Monitor mode in effect (paragraph 3.2.6).

LOCE or **DUPE** Edit keys local or duplex (paragraph 3.2.5).

EDTL, EDTP, INSL or **INSP** EDT indicates whether a character insert or delete operation will effect only the line, or the full page. INS indicates insert character mode is in effect.

KLOK Keyboard is locked out.

PROT Protect mode in effect (paragraph 3.1.4).

GRPH or H.I. Graphics or half intensity mode is in effect.

HDX, FDX, BLK or **LOC** Half Duplex, Full Duplex, Block or Local mode in effect.

The baud rate currently in effect for the main I/O port (50 to 19.2K).

P3ER Main port error—either Data Carrier Detect or Data Set Ready is false at the main I/O port.

SEND Transmission in progress.

Operating modes displayed on the status line can be changed using the setup mode. Press the SHIFT and SETUP keys simultaneously and the cursor will appear over the edit key execution field on the status line. Pressing T (for toggle) will then cycle the terminal through every possible choice for that mode. Press → and the cursor will move to the next field. Pressing T again will cycle that mode, etc. Press SHIFT/SETUP again to exit from the setup mode. Modes other than those displayed on the status line can be changed only by entering the appropriate command as described in paragraphs 3.2.6 and 3.2.7.

3.1.3 Display Memory Organization. If your terminal has only 24 lines of display memory installed, it is organized as one 24-line page and you can skip the rest of this paragraph. If you don't know how many lines of memory the terminal has you can find out by typing SHIFT/ESC and SHIFT/K several times (command to advance page) and watching the page number in the first field of the status line. If it remains at 0, the terminal has only one page. If it cycles 0..1..0..1 there are two pages (48 lines); 0..1..2..0 indicates three pages; 0..1..2..3..0 indicates four pages (96 lines).

This also demonstrates the first principle of multiple page operation: the terminal treats multiple pages as a ring—the first page follows the last.

In terminals with more than 24 lines of display memory you have several choices of how it is organized and used. If the maximum of 96 lines of memory is installed it may be organized as four 24-line pages (default condition at turn-on), two 48-line pages, or one 96-line page. If 48 lines are installed they may be 2×24 (default) or 1×48. Seventy two line memory may be 3×24 (default) or 1×48. Keystrokes for entering commands to change memory organization are given in paragraph 3.2.7.

Note

Changing display memory organization clears the entire memory.

The second principle of multiple page operation is that editing commands are limited to the page but not to the display window. A "Clear Unprotected" command, for example, will clear an entire 48-line page, not just the 24 lines being displayed, but will not effect any page not displayed. The one exception is setting or clearing column tab stops; all pages have the same column tab stops at all times.

The terminal keeps a separate cursor address and line lock list for each page. Any time the display window is shifted from page to page the cursor will be in the location it was in when that page was last displayed, and any locked lines will display in their original position.

At turn on, neither protection nor auto page/vertical wraparound are in effect. When the cursor reaches the bottom row of the page, it will normally remain there (A, figure 3–1). As new lines of data are entered, old data scrolls up, and data at the top of the page is deleted from memory. The display window will move to another page under three conditions (B, figure 3–1):

- If an "Advance Page" or "Back Page" command is given.
- If a cursor address command specifying another page is given.
- If a "Print" command is given (the old page will be output at the auxiliary port).

In some applications it may not be desirable to permit data to be scrolled out of memory. Two methods of preventing it are provided: protection, and/or auto page/vertical wraparound mode. With **protection** in effect, when the cursor passes the bottom row of the displayed page (C, figure 3–1) it jumps to the top row of the same page. The display does not scroll. The display window moves to another page under the same conditions listed above.

When the auto page/vertical wraparound mode is in effect, when the cursor reaches the last row on a page a new line of data causes the terminal to automatically advance to the next page (D, figure 3–1). If there is only one page the cursor wraps up to the top row of the page.

3.1.4 Protection. When protection is in effect it does much more than change cursor movement relative to the display page as described in the preceding paragraph.

- All data entered in half intensity (including video attribute tags, which display as half intensity spaces) and all graphics characters are protected from being overwritten or deleted from the keyboard.
- Insert/delete operations are confined to the unprotected field or line the cursor is in to preclude moving protected data.
- If one of the "Send Unprotected" modes described in paragraph 3.3 is used, protected data is not transmitted, a field delimiter is substituted for each protected field instead.
- The terminal may be conditioned to transmit all data, or to transmit only unprotected data. When only unprotected data is transmitted, a field separator (paragraph 3.4.3) is substituted for each half intensity or graphics field. When all data is transmitted, half intensity fields are bracketed by "Half Intensity On" and "Half Intensity Off" commands; graphics by "Graphics On" and "Graphics Off" commands; and an appropriate "Select Video Attribute" command substituted for

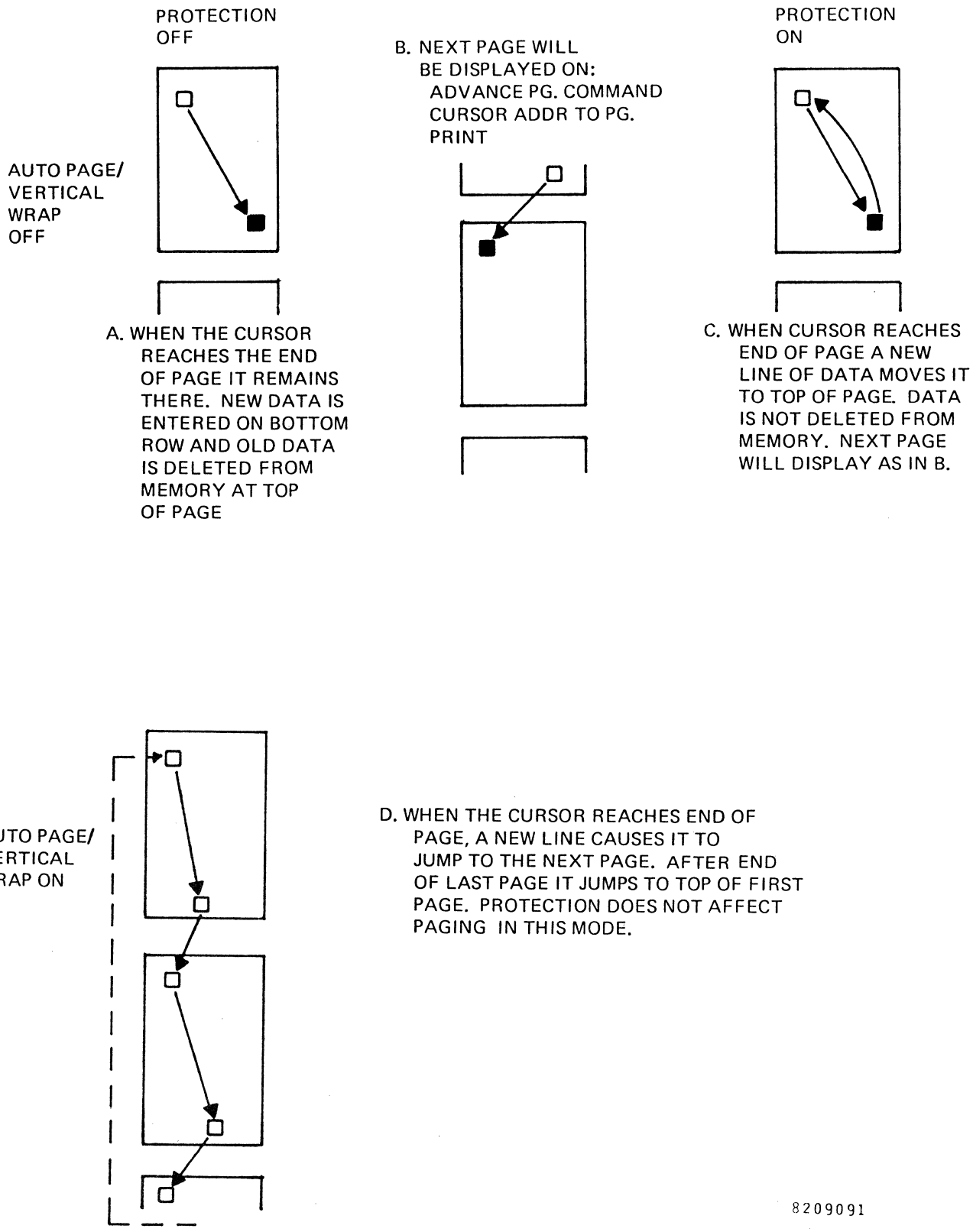


Figure 3–1. Multiple Page Memory Operation

attribute tags. In other words, the data transmitted by the terminal is such that it would replicate the display if it were received by the terminal.

- In a "Formatted Print" (PRT0) operation, a space character is substituted for each protected character in the output to the auxiliary port.
- Tab operations become "Field Tabs". A forward tab moves the cursor to the first location in the next unprotected field down screen. A back tab moves it to the first "Start of Protected Field" location upscreen.

3.2 KEYBOARD OPERATION

3.2.1 Introduction. The keyboard contains several functional groups of keys arranged as shown in figure 3–2. The alphanumeric and cursor movement keys automatically repeat if they are held down for longer than ¾ second.

3.2.2 Typewriter Cluster and Numeric Pad. The typewriter cluster operates like a standard typewriter keyboard, generating lower case letters and numbers when a key is entered without SHIFT, and upper case letters and symbols when a key is entered with SHIFT. The ALPHA LOCK key functions like a typewriter "Shift Lock" but it effects only the A to Z keys. The numeric pad duplicates the functions of the corresponding keys in the typewriter cluster, with ENTER performing the same function as RETURN, and is provided for convenience in entering numeric data. These keys are not effected by SHIFT or ALPHA LOCK.

Two additional "character" keys, not found on a typewriter, are also provided: ESC and DEL. These generate the ASCII Escape and Delete characters. These are commonly used to divert or terminate program execution and to delete the previous transmitted character, respectively, but what happens when they are transmitted is entirely a function of your computer program.

Two additional keys modify what is generated by the alphanumeric keys: CTRL (control) and FUNC (function). Appendix A lists the full 128 character ASCII set. In addition to the alphanumeric and symbol characters, there are two columns of "control codes", for most of which no dedicated key is provided; this is the function of the CTRL key. It acts like the SHIFT key in that it modifies the character generated by an alphanumeric key when the two are depressed together. Appendix A shows the keystrokes for generating each of the ASCII control codes. It also shows the two character mnemonic that will display in those circumstances when control codes are displayed by the terminal. Table 3–1 lists the hexadecimal code for the ASCII character generated by each key without SHIFT, with ALPHA LOCK, with SHIFT, with CTRL, and with both CTRL and SHIFT. Function key operation is described in paragraph 3.2.8.

Table 3–1. Alphanumeric Key Hex Codes (Sheet 1 of 2)

KEY	UNSHIFTED	ALPHA LOCK	SHIFTED	CTRL	CTRL/SHIFT
A	61	41	41	01	01
B	62	42	42	02	02
C	63	43	43	03	03
D	64	44	44	04	04
E	65	45	45	05	05
F	66	46	46	06	06
G	67	47	47	07	07
H	68	48	48	08	08
I	69	49	49	09	09
J	6A	4A	4A	0A	0A
K	6B	4B	4B	0B	0B
L	6C	4C	4C	0C	0C
M	6D	4D	4D	0D	0D

Table 3–1. Alphanumeric Key Hex Codes (Sheet 2 of 2)

KEY	UNSHIFTED	ALPHA LOCK	SHIFTED	CTRL	CTRL/SHIFT
N	6E	4E	4E	0E	0E
O	6F	4F	4F	0F	0F
P	70	50	50	10	10
Q	71	51	51	11	11
R	72	52	52	12	12
S	73	53	53	13	13
T	74	54	54	14	14
U	75	55	55	15	15
V	76	56	56	16	16
W	77	57	57	17	17
X	78	58	58	18	18
Y	79	59	59	19	19
Z	7A	5A	5A	1A	1A
1 !	31	31	21		—
2 @	32	32	40		00
3 #	33	33	23		—
4 $	34	34	24		—
5 %	35	35	25		—
6 ^	36	36	5E		1E
7 &	37	37	26		—
8 *	38	38	2A		—
9 (	39	39	28		—
0)	30	30	29		—
— _	2D	2D	5F	—	1F
\ |	5C	5C	7C	1C	1C
{ }	7B	7B	7D	1B	1B
[ ]	5B	5B	5D	1D	1D
; :	3B	3B	3A	—	—
' "	27	27	22	—	—
, <	2C	2C	3C	—	—
. >	2E	2E	3E	—	—
/ ?	2F	2F	3F	—	—
~ `	60	60	7E	00	1E
9	39	39	39	—	—
8	38	38	38	—	—
7	37	37	37	—	—
6	36	36	36	—	—
5	35	35	35	—	—
4	34	34	34	—	—
3	33	33	33	—	—
2	32	32	32	—	—
1	31	31	31	—	—
0	30	30	30	—	—
,	2C	2C	2C	—	—
.	2E	2E	2E	—	—
-	2D	2D	2D	—	—
SPACE BAR	20	20	20	—	—
LINE FEED	0A	0A	0A	—	—
RETURN	0D	0D	0D	—	—
ENTER	0D	0D	0D	—	—
DEL	7F	7F	7F	1F	1F
ESC	1B	1B	LOCAL ESC	—	—

LOCAL OPERATION

3.2.3 SETUP NO SCROLL Key. When pressed without shift, this key causes the terminal to stop updating the display. Received data will back up in the terminals 256 character input buffer; and if the buffer is filled beyond 90% of capacity, an XOFF will be transmitted to the host computer (or the terminal's Data Terminal Ready output goes false if XOFF protocol has been disabled) and TBSY displayed on the status line. Pressing the key a second time causes the terminal to resume updating the display and to send an XON (or make DTR true) when its input buffer empties.

When this key is depressed with SHIFT, the terminal stops updating the display as above and enters the "Setup Mode". The T, → and ← keys may then be used to temporarily change operating mode selections as described in paragraph 3.1.2.

3.2.4 Break Key. Pressing this key without shift causes the terminal to hold the transmission line to the host computer in the "Space" or "0" state for ¼ second. It has no function within the terminal and should be used only as directed in the operating manual for your system (it may disconnect you).

Depressed twice with SHIFT, the BREAK key causes a limited **local reset**. It stops printout and cancels protection, Keyboard lock and half intensity modes if in effect. Nothing is transmitted.

3.2.5 Editing Keys. The editing keys (figure 3–2) are used to perform insert, delete, cursor movement, clear, print and send operations. If the terminal is set up for "Local Edit" (LOCE on status line), nothing is transmitted as a result of these keystrokes. In interactive half or full duplex (HDX or FDX), if the terminal is set up for "Duplex Edit" (DUPE on status line), these keys operate like the alphanumeric keys; in half duplex characters are transmitted and the function performed; in full duplex characters are transmitted and the function is performed only if they are echoed back to the terminal. The one or two character sequence transmitted for each keystroke is listed in table 3–2. Insert character and delete character operation depends in whether the terminal is in "Edit Line" or "Edit Page" mode (EDTL or EDTP on status line). In EDTP mode, inserting or deleting a character causes all data from the cursor location to the end of the page to move. A character is deleted from or added to display memory at the end of page. In EDTL mode, only characters from the cursor location to the end of the line (end of field if protection is in effect) move. EDTL is automatic when protection is in effect.

TAB operation is like a typewriter unless protection is in effect, in which case it operates as described in paragraph 3.1.4 Clear/erase operation is described in paragraph 3.4, send in paragraph 3.3 and print in paragraph 3.5. The remaining editing key functions are self evident.

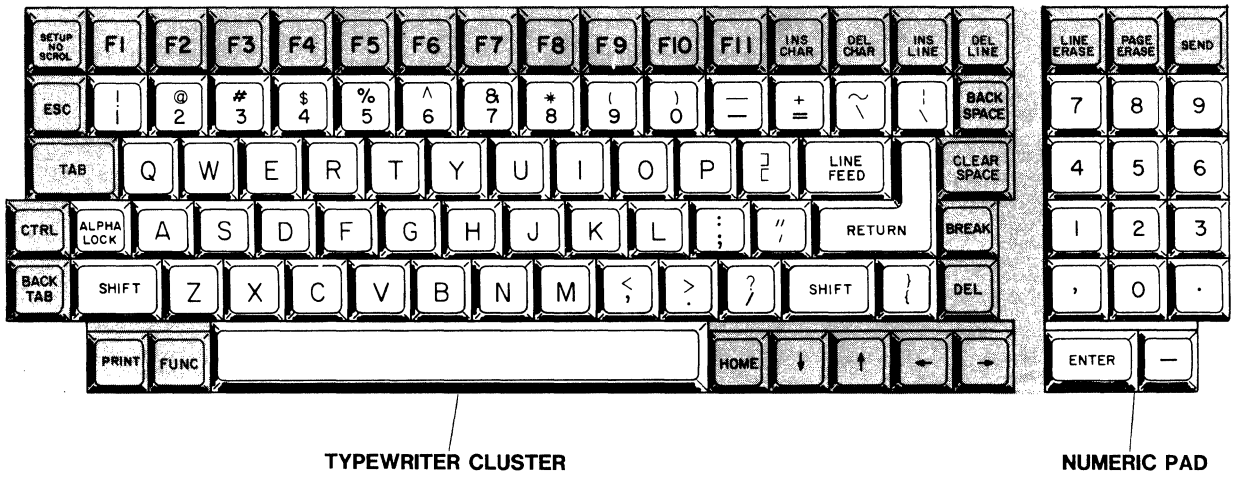
3.2.6 Special Command Keystrokes. The numeric keys in the typewriter cluster, depressed with the CTRL key, permit operator selection of some terminal functions as shown at the bottom of figure 3–2. **Monitor Mode** is provided as a system troubleshooting and debugging aid. When in effect, MONT displays on the status line and the terminal does not execute commands (except the "Exit Monitor Mode" command). It acts like a line monitor and displays each character received or typed. Control codes display as a two character mnemonic in a single character window as listed in Appendix A. Neither half intensity nor graphics may be in effect for proper display.

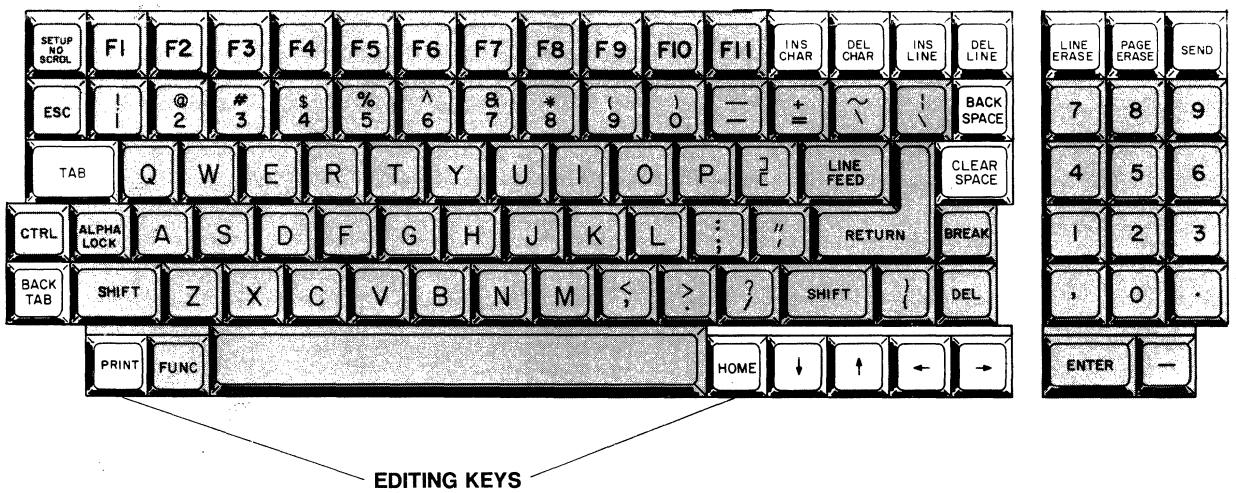
When key click is enabled each keystroke is acknowledged by a tone, and when the margin bell is enabled the terminal beeps when the cursor passes

Table 3–2. Characters Transmitted by Editing Keys in Duplex Edit Mode

KEY	UNSHIFTED	SHIFTED
INS CHAR	ESC Q	ESC q
DEL CHAR	ESC W	ESC r
INS LINE	ESC E	ESC N
DEL LINE	ESC R	ESC O
LINE ERASE	ESC T	ESC t
PAGE ERASE	ESC Y	ESC y
SEND[1]	ESC 7	ESC 6
BACK SPACE	BS	BS
CLEAR SPACE	SUB	ESC*
HOME	RS	RS
↓	SYN	SYN
↑	VT	VT
←	BS	BS
→	FF	FF
TAB	HT	HT
BACK TAB	ESC I	ESC I
PRINT	ESC P	ESC L

[1]Default value (refer to paragraph 4.7).





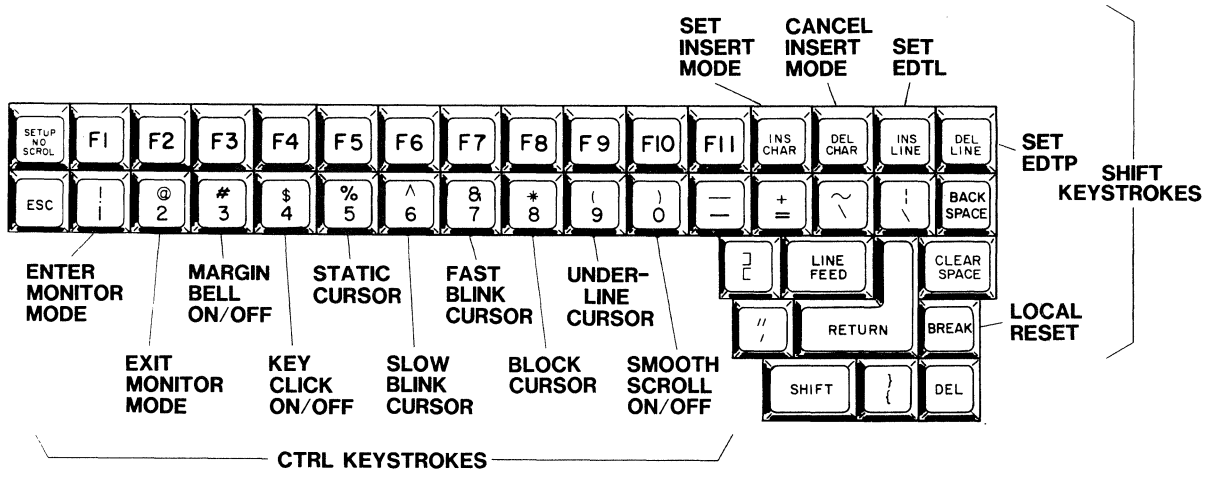


Figure 3–2. Keyboard

column 72 due to keyboard entry. These elections, and choice of cursor representation are purely a matter of operator preference and do not effect how the terminal communicates.

When smooth scroll is enabled, the displayed data moves up or down smoothly at a rate of 5 rows per second. This forces the terminal to limit the rate at which it empties its input buffer to the same rate. If the host computer responds to XOFF and XON commands (DC3 and DC1) by suspending and resuming transmission, the terminal will automatically limit the input to the smooth scroll rate. As an alternative, if the computer responds to a drop in the terminal's Data Terminal Ready signal by suspending transmission, input can be controlled by this signal with the XOFF/XON protocol disabled (by the ᶜN command). If the computer does not respond to these commands, or this feature is disabled, smooth scroll will probably not be useable at baud rates greater than 1200 unless some other method of limiting the transmission rate is used in the program.

Keystrokes are also provided to change editing modes without using the setup mode. The INS CHAR key normally causes the one character following to be inserted. Pressed with SHIFT it will place the terminal in the insert mode (INSL or INSP on status line). All subsequent characters will then be inserted until the mode is cancelled by ˢDEL CHAR. The ˢINS LINE and ˢDEL LINE keystrokes put the terminal in the edit line and edit page modes, respectively.

3.2.7 Keyboard Entered Commands. As described in Section IV, a received ESC character conditions the terminal to treat one or more characters following it as a command. The same result can be obtained from the keyboard using the "Local Escape" feature. Entering ˢESC causes the terminal to treat what follows as a local command. If the following keystroke is a control code (paragraph 3.2.2) the terminal will store the control code in display memory. If it is a valid command the terminal will execute it. Keystrokes for some commands are listed in table 3–3. Some do not require the introductory ESC character. All of the commands listed in Section IV may be entered at the keyboard, only those deemed most useful from the keyboard are listed here. The procedure for loading a function key from the keyboard is given in the following paragraph.

Table 3–3. Most Useful Keyboard Commands

FUNCTION	TO SET OR ENABLE	TO RESET OR DISABLE
Blank Cursor	ˢESC (period) 0	(See Figure 3–2)
Tab Stop	ˢESC 1	ˢESC 2 (Column) ˢESC 3 (All)
Line Lock	ˢESC ˢ! 1	ˢESC ˢ! 2
Disable XOFF/XON Protocol	ᶜN	ᶜO
Page Size[1] (24 line)	ˢESC \ 1	
(48 line)	ˢESC \ 2	
(96 line)	ˢESC \ 3	
Auto Pg/Vert Wrap	ˢESC v	ˢESC w
Next Page	ˢESC ˢK	
Back Page	ˢESC ˢJ	
Reverse Video	ˢESC b	ˢESC d
Aux Port on Line	ˢESC ˢ@	ˢESC ˢA
Aux Port Bidirectional	ᶜR	ᶜT
Display User Line	ˢESC g	ˢESC h
Load User Line[2]	ˢESC f	
Send User Line	ˢESC ˢZ 0	

1. Clears display memory (all pages)
2. RETURN key will terminate loading

3.2.8 Function Key Operation. The Esprit III terminal has two function key modes. One is predetermined using the FUNC key, the other is user programmable using the keys labled F1 through F11. When the FUNC key is held down while another alphanumeric keystroke is entered (including a control code) the terminal transmits a three-character sequence: SOH the alphanumeric character CR. In hex, the sequence is: 01 (char. from table 3–1) 20. This provides a means of communicating with the host computer without affecting the display. These sequences have no generalized meaning, however, they are useful only if your computer has been programmed to attach some meaning to them.

The F1 through F11 keys may be down line loaded with two functions per key, one shifted and one unshifted, for a total of 22 functions. Furthermore, each function may be programmed to operate in any one of three ways: transmit only, local only, or both. At power turn on, the keys are set for transmit only, and each key is loaded with a three character sequence as follows:

Key	Unshifted	Shifted
F1	SOH @ CR	SOH ` CR
F2	SOH A CR	SOH a CR
F3	SOH B CR	SOH b CR
F4	SOH C CR	SOH c CR
F5	SOH D CR	SOH d CR
F6	SOH E CR	SOH e CR
F7	SOH F CR	SOH f CR
F8	SOH G CR	SOH g CR
F9	SOH H CR	SOH h CR
F10	SOH I CR	SOH i CR
F11	SOH J CR	SOH j CR

Pressing F1, therefore, will generate the same sequence as FUNC/SHIFT/@.

The function keys may be used in several ways:

- The default sequences may be interpreted by an application program to call for predetermined operations.
- They may be loaded remotely and interpreted by an application program to call for predetermined operations.
- They may be loaded remotely or from the keyboard to generate frequently used character strings, either for transmission in Interactive mode or to be added to the display in Block mode.
- They may be loaded with command strings to be executed locally.

The following example illustrates the later application. Any of the remote commands described in Section IV can be issued from the keyboard in Local Escape mode. Table 3–3 lists only a few of the most useful ones. Some of the command strings are lengthy, and if the function keys are not being used for other purposes they may be used to store command strings. The following should be noted: a control character (any character in column 0 or 1, Appendix A) must be preceded by ^P to be loaded in a function key.

Typing the first string of keystrokes in figure 3–3 will load a command string in ^F1 to move a line up in the display. The sequence below the line loads F1 with a command string to move a line down. Once loaded, typing F1 will cause the line the cursor is on to move down and be interchanged with the line that was below it. ^F1 will move the line the cursor is on up. Because the sequences use insert and delete line you must have one row free at the bottom of the page or a row of data will be lost.

3.3 SEND OPERATION

3.3.1 Default. At power turn-on, the SEND key will cause transmission of all data from the home location to and including the cursor location. ^SEND will cause transmission of all data from the start of line to the cursor location. If protection is in effect protected fields will be transmitted, with each field bracketed by start of protected field and end of protected field delimiters. An end of transmission delimiter will be appended in both cases. Delimiters are as described in paragraph 3.4.3.

In block and/or edit key local modes, only the data and delimiters are transmitted. In half duplex with duplex edit keys, the transmission is preceded by the key code (ESC 7 unshifted, ESC 6 shifted). In full duplex with duplex edit keys the key code is transmitted but the data is sent only when the command is echoed. This mode is typically used when the computer has to assign an input buffer area before it is prepared to receive a batch of data, or when equipment permitting multiple terminals to share a communication channel is employed and the channel must be assigned to the terminal before batch transmission is permitted.

3.3.2 Send Key Alteration. The SEND key can be reprogrammed to cause any two of the six transmission modes described here in lieu of the default values (refer to paragraph 4.7).

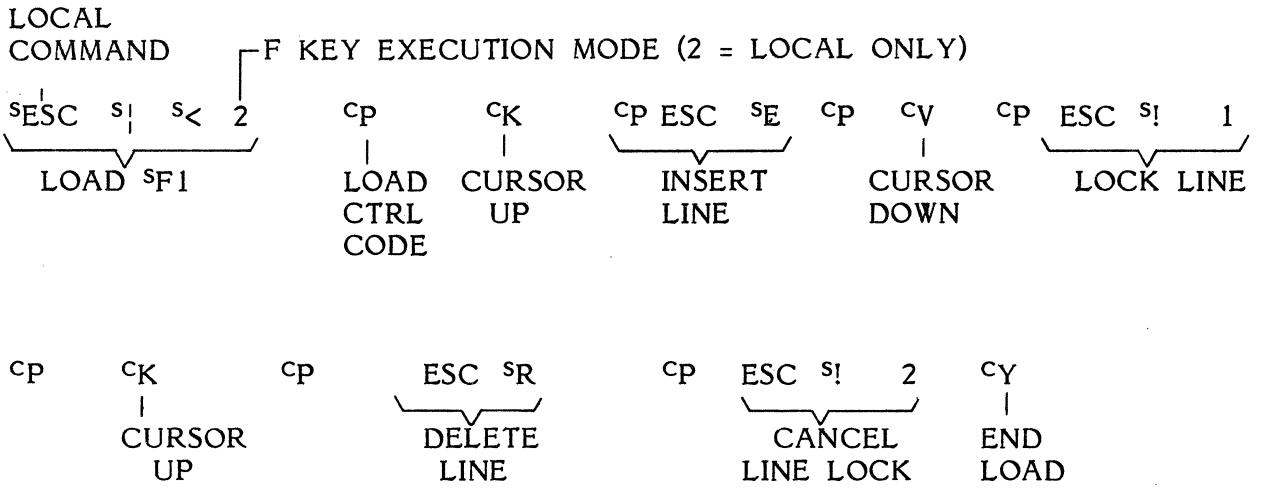


Figure 3–3. Function Key Loading Example

3.3.3 Defined Block (Message) Transmission. A third transmission mode is available by remote command (ESC s or ESC S). In this mode, data from the first displayed start-of-text (STX) character up-screen from the cursor, to the first displayed end-of-text (ETX) character following the STX is transmitted. The cursor will be placed over the ETX character. If there is no STX, transmission will start at home. If there is no ETX, transmission will stop at the end of the page and the cursor placed at the home location.

Note

An STX can be entered from the keyboard by typing SESC CB (SX displays) and an ETX by SESC CC (EX displays). However this mode is intended primarily for remote control.

3.3.4 Send Unprotected. For each of the three transmission modes described above (Line, Page, Defined Block) a command is available to send only unprotected data within the range of the transmission. In this case, a field delimiter is substituted for each protected field.

3.4 DATA COMPRESSION AND SEPARATION

3.4.1 Data Compression. Clear operations normally clear the affected areas of display memory to spaces. The CLEAR SPACE key clears the entire page; LINE ERASE clears from cursor to end of line; PAGE ERASE clears from cursor to end of page. Remote commands are available to do the same (paragraph 4.6). If no data is subsequently entered in a location and the area is transmitted, the terminal transmits the space characters. Any of the above keystrokes combined with SHIFT (or a remote "Clear to Nulls" command) clears the affected area to NUL characters. These display as spaces but the terminal will not transmit the NULs, compressing the transmitted data stream to include only characters actually entered into display memory. This means that fields and lines will be of variable length, making some means of separation necessary to distinguish the end of a field or line from the start of the next. This is accomplished by the delimiters described in paragraph 3.4.3.

3.4.2 Space Substitute. As noted above, keystrokes and commands are available to clear to nulls.

However, blank areas created by insert or delete operations or a rollup will continue to be space characters (e.g. delete character will add a space at end of line or end of page). If this is not desired, a NUL can be substituted by the command ESC e NUL. Thereafter, all "clear" operations will clear to nulls. This command may also be used to substitute any other character for clear operations if having a displayed character is desired.

3.4.3 Delimiters. In batch transmissions the terminal sends five delimiters to separate fields and lines. A "New Line" delimiter is inserted after each line and an "End of Text" delimiter is appended after each transmission. When only unprotected data is transmitted, a "Field Separator" is substituted for each protected field (half intensity or graphics). When both protected and unprotected data is transmitted a "Start Protected Field" delimiter precedes each half intensity field and an "End Protected Field" delimiter follows it. The default values are the same as the "Half Intensity On" and "Half Intensity Off" commands. The default values for the delimiters are listed below. Each may be two characters, although the default condition uses only one for line, field and end of text (the NULS are not transmitted).

Delimiter	Default Characters	
Field	FS	NUL
Line	US	NUL
Start Prot. Field	ESC	)
End Prot. Field	ESC	(
End of Text	CR	NUL

Any of these delimiters may be changed by the appropriate command (paragraph 4.7). A delimiter may be eliminated by setting it to NUL NUL.

3.5 AUXILIARY I/O PORT OPERATION

3.5.1 Introduction. The auxiliary I/O (Printer) port is capable of five different modes of operation (figure 3–4). Two modes cause data in display memory to be output at the port; two modes place the port "on-line" (all data received by the terminal is copied at the auxiliary ouput); and the fifth mode places the host computer in direct two-way communication with the device connected to the port.

3.5.2 Formatted Print. When this mode is initiated by the PRINT key or remote command, PRT0 displays on the status line and the entire current page is output at the auxiliary port. Space characters are substituted for any protected data in the display and a carriage return, line feed and one null character are inserted after each row. An acknowledge (ASCII ACK, hex 06) will be transmitted to the host when output is completed.

Note

If the terminal has more than one page of display memory, either the preceding or following "print" operation will cause it to advance to the next page. Entries may be made on the new page while data is being output from the old. Care must be taken not to initiate a new output until the old one is completed (PRT# not displayed or ACK received).

3.5.3 Verbatim Print. When this mode is initiated by SPRINT or remote command, PRT1 displays on the status line. Operation is like formatted print above, except the entire page is output without additions or substitutions. This mode may be used, for example, to include commands to a printer in the text stream, or to provide a printout wider than 80 columns by storing CR or LF codes at the appropriate locations. Note carefully however, that graphics characters and video attribute tags are stored in display memory as ASCII control codes and these codes will be output in this mode.

3.5.4 On-Line With Display. PRT2 displays on the status line while this mode is in effect. All data received by or echoed back to the terminal is output at the auxiliary port. In half duplex, keyboard data is also output. If either formatted or verbatim print is initiated this mode will be cancelled.

3.5.5 On-Line Without Display. PRT3 displays on the status line and received data is output at the auxiliary port but is not stored or displayed by the terminal. Keyboard entries will not be permitted.

3.5.6 Bidirectional. BDIR displays on the status line. Data received by the terminal is passed out the auxiliary port without buffering by the terminal. Baud rate, parity, word length, etc. will be exactly as received. Data received from the auxiliary device will be relayed to the host computer in the same manner.

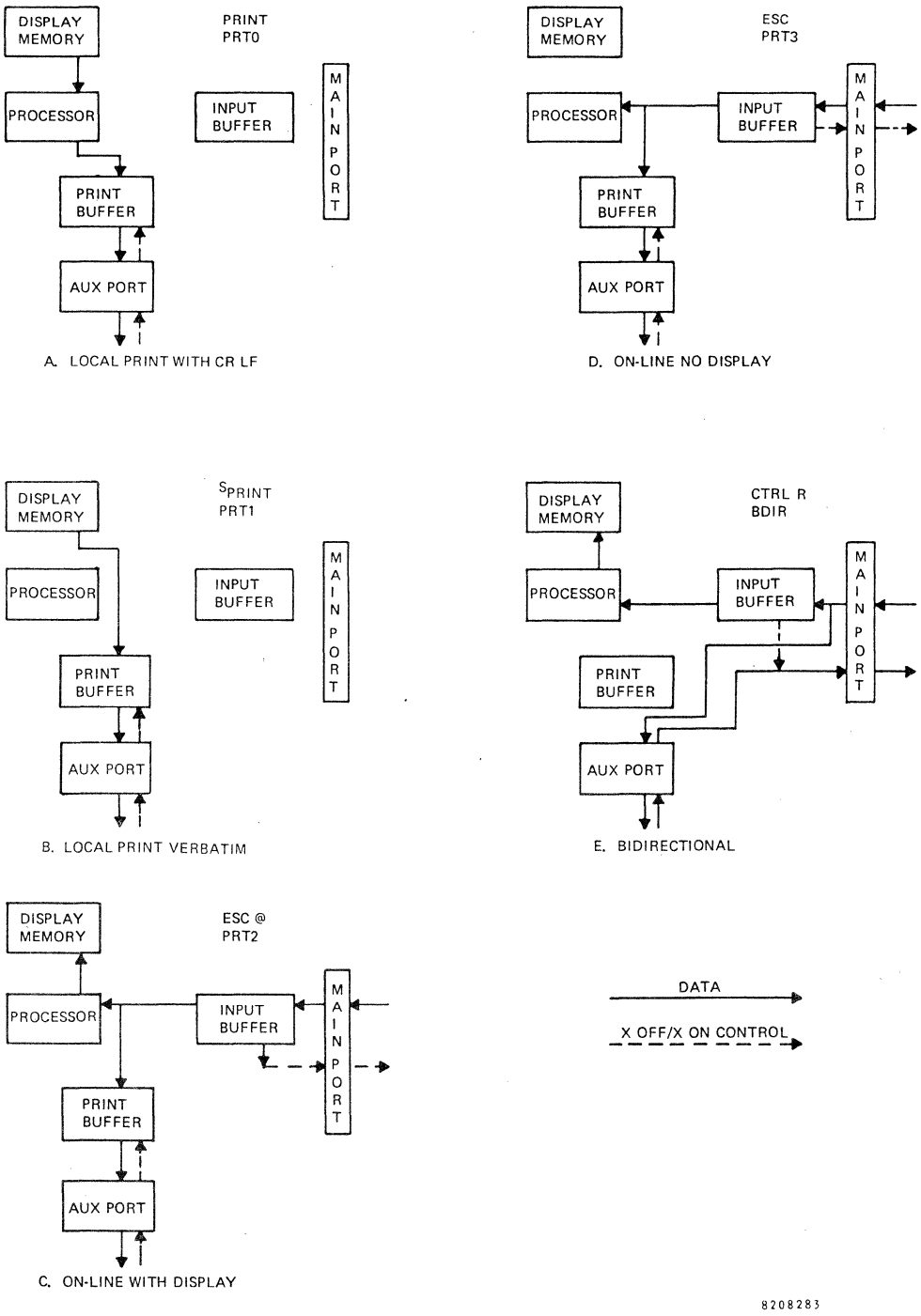


Figure 3–4. Auxiliary I/O Port Modes of Operation

3.5.7 Buffer Operation. The auxiliary port baud rate is independent of the main port baud rate. Word length and parity will be the same unless changed by remote command (paragraph 4.10). Except in the bidirectional mode, auxiliary output data passes through the terminal's 256 character print buffer. Data flow may be controlled by the auxiliary device: transmitting the XOFF (DC3 character) or dropping the auxiliary "Data Terminal Ready" signal will cause the terminal to suspend output. PBSY will display on the status line. Transmitting an XON (DC1) or raising Data Terminal Ready will cause it to resume. If the terminal's print buffer fills in PRT0 or PRT1 mode, it suspends transfer of data to it until space is available. If it fills in PRT2 or PRT3 (online) mode, the terminal will stop updating the display and begin to fill its 256 character input buffer. If this buffer exceeds 90% of capacity, the terminal will transmit an XOFF (DC3) to the host, followed by an XON (DC1) when the input buffer empties. In PRT3 mode (no display) the buffers act as a single 512 character buffer. XOFF/XON will be transmitted as the input buffer fills and empties.

3.6 VIDEO ATTRIBUTES AND GRAPHICS

3.6.1 Introduction. The Esprit III terminal permits displaying data in half intensity, reverse video, eight colors, and combinations thereof. It also provides the capability of displaying continuous line graphics.

3.6.2 Field Attributes. A field attribute is assigned by the command ESC G followed by one of the following selection parameters;

Attribute	Char. (ASCII)	Char. (Hex)
Green	0	30
Cyan	1	31
Yellow	2	32
White	3	33
Green, Reverse	4	34
Cyan, Reverse	5	35
Yellow, Reverse	6	36
White, Reverse	7	37
Black	8	38
Blue	9	39
Red	:	3A
Magenta	;	3B
Black, Reverse	<	3C
Blue, Reverse	=	3D
Red, Reverse	>	3E
Magenta, Reverse	?	3F

An attribute tag will be stored in display memory and the attribute will apply from the cursor location to the next attribute tag or end of screen if there is no following tag. The tag will display as a half intensity space and will be protected when protection is in effect.

Note

When programming to set up field attributes on the display, the obvious method is not the best method. If the cursor is positioned at the starting point of the second attribute etc., each attribute bute" command sent, then moved to the start point on the second attribute etc., each attribute will apply to the end of display when set, then be cancelled by the following attribute, which will then apply to the end of screen, etc. This is very distracting. The recommended method is to blank display (ESC o) while attributes are being set up and then unblanking it (ESC n), or setting attributes from the bottom of the display upward.

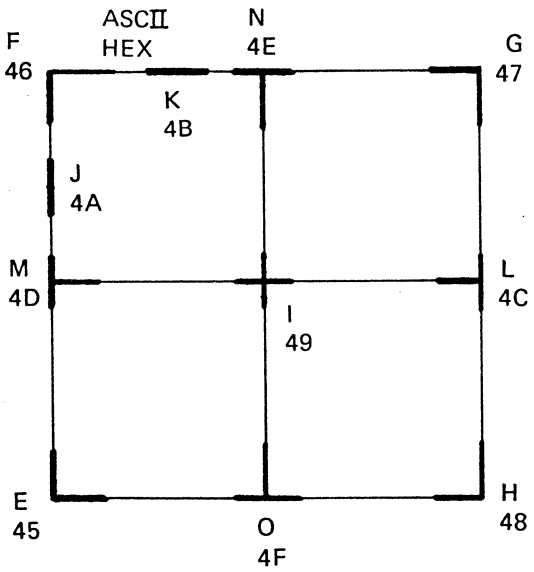
3.6.3 Half Intensity. All data entered after a "Half Intensity On" command, ESC), or while the terminal is placed in half intensity in setup mode, will display in half normal intensity. This data will be protected when protection is in effect. Half intensity entry will be discontinued by taking the terminal out of half intensity in setup mode or by the "Half Intensity Off" command: ESC (. Stored ASCII control codes (columns 0 or 1, Appendix A) will become graphics (col. 0) or attribute tags (col. 1).

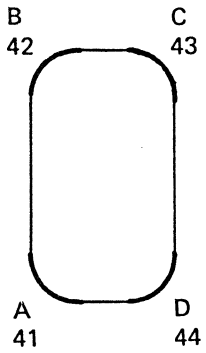
3.6.4 Graphics. The terminal has fifteen line drawing graphics characters as shown in figure 3-5. Unlike the normal characters, which always have at least one dot clear on all sides, the graphics extend to the edge of the character window so continuous lines can be formed (see cover). The "Graphics On" command (ESC $), or setting graphics in setup mode, causes subsequent characters to be converted to graphics. Figure 3−5 shows a selector character for each graphic element; F will display an upper left corner, N as a horizontal line, etc. Graphics characters are protected when protection is in effect. Entering graphics is discontinued by the "Graphics Off" command (ESC %) or by cancelling graphics in setup mode.

Note

Both attribute tags and graphics characters are actually stored in display memory as ASCII control codes (Appendix A). A tag is stored as a

column 1 code in the same row as the selector character, ie. attribute 1 stores as a half intensity DC1, 2 as DC2. Graphics are stored as a column 0 code, A as SOH, B as STX etc. In some circumstances these control codes are transmitted or output at the auxiliary port (transmit with protection off or PRT 1 mode).





P
50 = SPACE

8208256

Figure 3–5. Characters for Selecting Graphics Elements

Section IV

REMOTE COMMANDS

4.1 INTRODUCTION

This section provides a description of the extensive remote command repertoire of the Esprit III terminal and lists the character sequence for each command. In several cases there is more than one sequence for the same command. Remote commands to the terminal are of two types: ASCII control codes (columns 0 and 1, Appendix A) which have meaning to the terminal, and escape sequences.

If a control code listed in this section is received by the terminal, the corresponding command will be executed. All other control codes are ignored. NUL codes which are not part of an escape sequence are not placed in the input buffer and may be used as "fill" characters to provide time delays without filling the buffer.

An escape character (ESC) is called a command "lead-in" and conditions the terminal to treat the character that follows it as defining a command. If the following character is a control code, the terminal treats the sequence as a command to store the control code. Stored control codes normally display as a two character mnemonic in a single character window as shown in Appendix A (NUL displays as a space), but there are exceptions as noted in paragraph 3.6.3.

If the character following ESC is from ASCII columns 2 through 7, it is treated as a command. If it is one of the sequences listed here, the associated command is executed; otherwise the sequence is ignored. In addition, some sequences require parameters, designated as p_S or p_1 p_2... in this section, which must follow the command sequence. Each parameter is a single ASCII character defining a selection (p_S) such as a video attribute, or a value such as column number for a cursor address. This section lists only one ASCII character for each available parameter. In general, there is more than one character which will give the same result. For example, the "Video Attribute" command (paragraph 4.4) lists parameters from column 4 of the ASCII chart. Characters from the same row of other columns will give the same result (e.g. ! 1 A Q a q all select a blank attribute).

4.2 TRANSMISSION MODE COMMANDS

Command (Parameter)					Description
ASCII	**Decimal**		**Hex**		
Enter Interactive Mode					
ESC C	27	67	1B	43	In the Interactive (Conversational) mode, characters generated by alphanumeric keys are transmitted when typed. In half duplex the characters are displayed, or acted upon if commands. In full duplex, only characters echoed back to the terminal are displayed or acted upon. Note that edit and cursor key operation may be programed differently than alphanumeric keys as described below, and function keys operate in accordance with the parameter loaded in each key.
Enter Block Mode					
ESC B	27	66	1B	42	In this mode, keyboard entries are stored on the display memory and not transmitted when typed. Transmission may be by page, defined block or line, and is initiated by pressing the SEND key or by remote command as described in paragraph 4.7.

Command (Parameter)						Description
ASCII	**Decimal**			**Hex**		
Enter Monitor Mode						In monitor mode, all characters received or entered at the keyboard, including control codes, are displayed in consecutive locations on the screen. Control codes are displayed as a two character mnemonic in a single character window. The only command executed is the "Exit" command.
ESC U	27	85		1B	55	
Exit from Monitor Mode						
ESC u	27	117		1B	75	
ESC X	27	88		1B	58	
Enter Local Mode						In local mode, no data is transmitted by the terminal and any received data or commands are ignored. LOC appears on the status line and the terminal's Data Terminal Ready and Request to Send signals will be false.
ESC c	27	99		1B	63	
Set Half Duplex						In Interactive Half Duplex, keyboard entries are processed for display and transmitted. In Interactive full Duplex, keyboard entries are transmitted, but are processed for display only when echoed. The editing keys may be local only with nothing transmitted, or can be programmed to operate like the alphanumeric keys by the commands described below. The terminal also controls its "Request to Send" output signal differently in half or full duplex as described in paragraph 4.5. Note that if the terminal is being switched between Interactive and Block modes to do local editing, it may be desirable to operate in half duplex, even if the communication channel is capable of full duplex, in order to avoid having to switch the echo on and off.
ESC D H	27	68	72	1B	44	48
Set Full Duplex						
ESC D F	27	68	70	1B	44	46
Edit Keys Local						In the local mode, keyboard editing functions (figure 2–2) are performed in display memory and nothing is transmitted.
ESC k	27	107		1B	6B	
Edit Keys Duplex						In the duplex mode, edit keys cause the corresponding command sequence to be transmitted, permitting the host computer to keep track of the display. The function is executed when entered, or when echoed, depending on whether the half or full duplex mode is in effect as described above.
ESC l	27	108		1B	6C	
Set Main Port Parameters (p_1 p_2 p_3 p_4)						This command overrides the switch selections at the terminal rear panel (paragraph 2.2).
ESC {	27	123		1B	7B	

ASCII	p1 Dec	Hex	Baud Rate
0	48	30	9,600
1	49	31	50
2	50	32	75
3	51	33	110
4	52	34	135
5	53	35	150
6	54	36	300
7	55	37	600
8	56	38	1,200
9	57	39	1,800
:	58	3A	2,400
;	59	3B	3,600
<	60	3C	4,800
=	61	3D	7,200
>	62	3E	9,600
?	63	3F	19,200

ASCII	p2 Dec	Hex	No of Stop Bits
0	48	30	1
1	49	31	2

ASCII	p3 Dec	Hex	Parity
0	48	30	None
1	49	31	Odd
3	51	33	Even
5	53	35	Mark (One)
7	55	37	Space (Zero)

ASCII	p4 Dec	Hex	Word Length
0	48	30	8 bits
1	49	31	7 bits

For example: To set the terminal to 1200 baud, 1 stop bit, even parity, 7 bit word, Send: ESC { 8 0 3 1

4.3 CURSOR AND PAGE CONTROL COMMANDS

Command (Parameter) **Description**

ASCII **Decimal** **Hex**

Cursor Attribute (p_S)

ESC . p_S 27 46 p_S 1B 2E p_S

The cursor will be blanked or displayed as defined by the parameter:

ASCII	Ps Dec	Hex	Cursor
0	48	30	No Display
1	49	31	Slow Blinking Block
2	50	32	Steady Block
3	51	33	Slow Blinking Underline
4	52	34	Steady Underline

Cursor Home

RS 30 1E

The cursor moves to the first unprotected location on the page (upper left corner if protection is not in effect).

Cursor Up

VT 11 0B

The cursor moves up one row in same column. No movement occurs if it is on the top row.

Command (Parameter)					Description
ASCII	**Decimal**		**Hex**		
Cursor Down					
SYN	22		16		The cursor moves down one row. No movement occurs if it is on the bottom row.
Line Feed					
LF	10		0A		The cursor moves down one row. Limits depend on protection and vertical wrap modes as described in paragraphs 3.1.3 and 3.1.4.
Reverse Line Feed					
ESC j	27	106	1B	6A	The cursor moves up one row. Action is the reverse of line feed.
Carriage Return					
CR	13		0D		The cursor moves to the first column of the present row. If auto line feed is selected, a line feed is also performed.
New Line					
US	31		1F		A carriage return and line feed are performed.
Cursor Right					
FF	12		0C		The cursor advances one column. If it is in the 80th column it advances to the 1st column of the next row.
Cursor Left					
BS	8		08		The cursor moves back one column. If it is in the first column it wraps to the 80th column of the row above. Motion ends at the home position.
Tab					
ESC i	27	105	1B	69	If protection is in effect, the cursor moves to the first position in the next unprotected field down screen. If protection is not in effect, the cursor moves to the next column tab stop.
HT	9		09		
Back Tab					
ESC I	27	73	1B	49	If protection is in effect, the cursor moves to the first position in the field it is in. If it is in the first position, it moves to the first position in the preceding unprotected field. If protection is off, a reverse column tab is performed.
Set Tab Stop					
ESC 1	27	49	1B	31	With protection off, a column tab stop is set in the position the cursor is in for all pages. With protection on, a half intensity space is written into the column the cursor is in for each row from the cursor position to the bottom of the page or the first protected character encountered.

Command (Parameter)					Description
ASCII	**Decimal**		**Hex**		
Clear Tab Stop					The tab stop in the column the cursor is in is cleared.
ESC 2	27	50	1B	32	
Clear All Tab Stops					All column tab stops are cleared in all pages.
ESC 3	27	51	1B	33	
Absolute Cursor Address (p_1 p_2 p_3)					The selected page is displayed and cursor moves to the row and column defined by the parameters. The parameters are described in Appendix B. Note that locking a line (paragraph 4.8) changes the row number of all lines below it.
ESC -	27	45	1B	2D	
Cursor Address in Page (p_2 p_3)					The cursor moves to the row and column defined by the parameters on the page presently displayed. If the address is not within the area presently displayed, the display window moves as necessary so the row the cursor is moved to is the top or bottom of the display.
ESC =	27	61	1B	3D	
Read Cursor Address (Row/Column)					The terminal will respond with the row parameter, column parameter and a CR. The parameters are defined in Appendix B.
ESC ?	27	63	1B	3F	
Read Cursor Address (Page/Row/Col)					The terminal will respond with the page number, row parameter, column parameter and a CR.
ESC /	27	47	1B	2F	
Set Page Size (p_S)					This command causes display memory to be organized as specified by the parameter:
ESC \	27	92	1B	5C	

p_S	Page Size
1	24 lines
2	48 lines
3	96 lines

This command also causes display memory to be cleared.

Advance Page					The next page is displayed with the cursor in the same location it was in when the page was last displayed (or home). Action wraps from the last page to the first page.
ESC K	27	75	1B	4B	
Back Page					The preceding page is displayed as described above.
ESC J	27	74	1B	4A	

Command (Parameter)				Description
ASCII	**Decimal**	**Hex**		
4.4 VIDEO CONTROLS				
Video Attribute (p_s) ESC G p_s	27 71 p_s	1B 47 p_s		A video attribute tag is stored at the current cursor location and the cursor advances one position. The selected video attribute will apply from the cursor location to the next attribute code or end of screen.
p_s ASCII	Decimal	Hex	Attribute	
0	48	30	Green	
1	49	31	Cyan	
2	50	32	Yellow	
3	51	33	White	
4	52	34	Green, Reverse	
5	53	35	Cyan, Reverse	
6	54	36	Yellow, Reverse	
7	55	37	White, Reverse	
8	56	38	Black	
9	57	39	Blue	
:	58	3A	Red	
;	59	3B	Magenta	
<	60	3C	Black, Reverse	
=	61	3D	Blue, Reverse	
>	62	3E	Red, Reverse	
?	63	3F	Magenta, Reverse	
				Note The two selections which correspond to the background color (para. 2.2) will result in blank video (e.g. if the background is black, selections 8 and < will produce blank fields).
Half Intensity On ESC)	27	41	1B 29	All subsequent data will display in half intensity. When the protect mode is used, half intensity data is protected from being overwritten from the keyboard. In some transmission modes (paragraph 4.7) protected data is not transmitted.
Half Intensity Off ESC (	27	40	1B 28	All subsequent data is displayed in full intensity.
Graphic Mode On ESC $	27	36	1B 24	Received characters are transposed to one of sixteen graphics characters (including space) as shown in paragraph 3.6.
Graphic Mode Off ESC %	27	37	1B 25	Graphics characters are always high intensity, regardless of the state of the "Half Intensity" command. However, they are protected when the protect mode is in effect.

Command (Parameter)					Description
ASCII	**Decimal**		**Hex**		
Reverse Video					This command causes reverse video over the entire screen. Characters will take on the color selected by the "Background Color" switches (paragraph 2.2) within a window controlled by the video attribute selection. Fields with a "Reverse Video" attribute will display as normal video.
ESC b	27	98	1B	62	
Normal Video					
ESC d	27	100	1B	64	
Blank Display					The "Blank" command causes the entire display, including the cursor and the status line, to be blank. Received data is entered in display memory and is displayed when the "Restore" command is received.
ESC o	27	111	1B	6F	
Restore Display					
ESC n	27	110	1B	6E	

4.5 EDITING COMMANDS

Page Edit					These commands determine the scope of the "Insert" and "Delete" commands. When page edit is in effect EDTP is displayed on the status line and insert and delete operations cause data to move from the cursor location to the end of the page. When line edit is in effect EDTL is displayed and insert and delete operations cause data to move to the end of line or end of field, whichever comes first. Line edit is automatic when protection is in effect.
ESC N	27	78	1B	4E	
Line Edit					
ESC O	27	79	1B	4F	
Insert Mode On					When the insert mode is in effect, INSL or INSP is displayed on the status line. Each character received causes the cursor and all data to the right of the cursor to move, to end of line or end of page depending on whether line or page edit is in effect, and the character is entered at the previous cursor location. One character is lost from display memory.
ESC q	27	113	1B	71	
Insert Mode Off					
ESC r	27	114	1B	72	
Insert Character					The one character following the command is inserted as described above. The only difference between insert mode and insert character is that the latter is self cancelling after one character.
ESC Q	27	81	1B	51	
Delete Character					The character at the cursor location is deleted. Data to the right, to end of line or page as described above, is moved left. The cursor does not move. One space character is added at the end of line or page in display memory.
ESC W	27	87	1B	57	

Command (Parameter)					Description
ASCII	**Decimal**		**Hex**		
Insert Line					
ESC E	27	69	1B	45	The line the cursor is on, and all unlocked lines below it, move down one line. The last line of the page is deleted from memory and a line of space characters is added at the cursor location with the cursor in the first column.
Delete Line					
ESC R	27	82	1B	52	The line the cursor is on is deleted and all unlocked lines below it move up one line. A line of space characters is added at the end of the page.

4.6 CLEAR COMMANDS

Load Substitute for Space Character (p_S)					"Clear" commands (except those which specify "clear to nulls") normally cause the terminal to clear the affected area to space characters. In addition, areas added to the display by insert and delete operations, or a rollup, are automatically cleared to spaces by the terminal. This command causes whatever character that follows it to be substituted for the space character in all such operations. Received or keyboard space characters are not affected.
ESC e	27	101	1B	65	
Clear All to Null					The entire page is cleared to NUL characters, which display as spaces. Half Intensity and protection are cancelled if in effect.
ESC *	27	42	1B	2A	
Clear Unprotected to Null					All unprotected data on the page is cleared to NUL characters. If half intensity is in effect they will take on the half intensity attribute.
ESC :	27	58	1B	3A	
Clear to End of page with Nulls					All unprotected data from the cursor location to the end of the page is cleared to NUL characters. If half intensity is in effect, the cleared area will take on that attribute.
ESC y	27	121	1B	79	
Clear to End of Line with Nulls					All unprotected data from the cursor location to end of line or end of field is cleared to NUL characters. If half Intensity is in effect, the cleared area will take on that attribute.
ESC t	27	116	1B	74	

Note

The preceding three commands correspond to pressing the CLEAR SPACE, PAGE ERASE and LINE ERASE keys, respectively, with SHIFT. The following three commands correspond to pressing the same keys without SHIFT.

Command (Parameter)					Description
ASCII	**Decimal**		**Hex**		
Clear Unprotected					These three commands are the same as the three preceding commands except that the affected area is normally cleared to spaces instead of NULs. If a substitute character has been loaded (by the first command in this paragraph), then the affected area will be cleared to that character.
SUB	26		1A		
ESC +	27	43	1B	2B	
ESC ;	27	59	1B	3B	
Clear to End of Page					
ESC Y	27	89	1B	59	
Clear to End of Line					
ESC T	27	84	1B	54	
Clear to Half Intensity					All unprotected data on the page is cleared to half intensity spaces (or the substitute character).
ESC ,	27	44	1B	2C	

4.7 SEND COMMANDS

Send Page (All)					All data (protected and unprotected) from the home position to the cursor location is transmitted. Protected fields are bracketed by start and end delimiters. Line delimiter characters are inserted after each row, and an end of text character is appended at the end of the transmission.
ESC 7	27	55	1B	37	
This is the default mode for the SEND key (Unshifted)					
Send Line (All)					All data on the line the cursor is on, from column 1 to the cursor location, is transmitted. Protected field and line delimiters and end of text character are inserted as in the "Send Page" command above.
ESC 6	27	54	1B	36	
This is the default mode for SSEND					
Send Defined Block (All)					All data from the stored start of text character (STX), or home position if there is no STX, to the stored end of text character (ETX), or end of page if there is no ETX, is transmitted. Protected field delimiters, line delimiters and end of text character are inserted as in the commands described above. The cursor is placed over the ETX character, or in the home position if there is no ETX character.
ESC s	27	115	1B	73	
Send Page (Unprotected)					These three commands are the same as the corresponding commands above except that protected data is not transmitted. A field delimiter is inserted for each protected field.
ESC 5	27	53	1B	35	
Send Line (Unprotected)					
ESC 4	27	52	1B	34	
Send Defined Block (Unprotected)					
ESC S	27	83	1B	53	

Command (Parameter)	ASCII	Decimal	Hex		Description
Protect Mode On					
ESC &	27	38	1B	26	When the protect mode is in effect, background data (low intensity characters, field attribute tags and graphics) cannot be written over from the keyboard. Protected data will not be transmitted if the transmission is initiated by one of the "Send Unprotected" commands, or by the SEND key if it is programmed to one of the unprotected modes as described below. Spaces are substituted for protected characters in a "Formatted Print".
Protect Mode Off					
ESC '	27	39	1B	27	

Program SEND Key (p_1 p_2)

ESC 0 27 48 1B 30

Programs the terminal so that either SEND or SSEND key depression initiates any one of the six "Send" modes described above. For example, to program SSEND to initiate a page (unprotected) transmission, the command is: ESC 0 0 5

p_1 = 0 for SSEND = 1 for SEND

p_2 = 7, 6, s, 5, 4 or S corresponding to the desired mode above.

Program Send Delimiters (p_S p_1 p_2)

ESC x 27 120 1B 78

This command permits overiding the default characters for each of the five delimiters inserted by the terminal during batch transmissions. The first parameter selects the delimiter as shown to the left. The second and third parameters (p_1 p_2) are the new delimiter characters. To change the end of line delimiters to LF CR, for example, the command is:

ESC × 1 LF CR

p_S	Delimiter
0	field
1	line
2	start protected field
3	end protected field
4	end of text

Transmit Terminal ID

ESC M 27 77 1B 4D

The terminal will respond with a six character sequence indicating the firmware version and the number of pages of memory as follows:

v . v, n CR

Where v.v is the firmware version (e.g. 2.0) and n indicates the display memory size as:

0 = 24 lines
1 = 48 lines
2 = 72 lines
3 = 96 lines

Transmit User/Status Line (p_S)

ESC Z 27 90 1B 5A

The terminal will respond by transmitting the data on the User or Status line as selected, followed by CR. p_S = 0 for the User line, and p_S = 1 for the Status line.

Command (Parameter)							Description
ASCII	**Decimal**			**Hex**			
4.8 SCROLLING CONTROLS							
Smooth Scroll On							When smooth scroll is enabled, new lines of data cause the display to scroll up smoothly at a rate of 5 rows per second (4.17 if the refresh rate is 50 Hz).
ESC 8	27	56		1B	38		
Jump Scroll On							
ESC 9	27	57		1B	39		
Lock Line							The line the cursor is on will be locked and the cursor moved down to the next unlocked line. If there is no unlocked line displayed below it, the cursor is moved up to the first available unlocked line. The maximum number of lines that can be locked on a page is 23. When a line is locked, it is frozen in position on the display and deleted from the active page. It does not have a row number and all active rows below it are renumbered. Locked lines are neither transmitted nor printed. The cancel command cancels all line locks on the page.
ESC ! 1	27	33	49	1B	21	31	
Cancel Line Lock							
ESC ! 2	27	33	50	1B	21	32	
Enable X OFF/X ON							When this feature is enabled, the terminal will automatically send an X OFF (DC3) character whenever its input buffer is approximately 90% full, and an X ON (DC1) when it is depleted.
SI	15			OF			
Disable X OFF/X ON							
SO	14			OE			
Vertical Wrap/Auto Page On							This mode provides a means of preventing new lines of data from causing old lines to be rolled up out of display memory, regardless of whether protection is on or off. The cursor will automatically go from the last line of one page to the first line of the next page. After the last line of the last page, it will wrap to the first line of the first page. If protection is off, old data can be written over, but line numbers never change. If this mode is off cursor movement depends on the protect mode. If protection is off, when the cursor reaches the bottom of the page it will remain on that line. Subsequent line feeds will cause new data to be entered on that line and all data above it will move up
ESC v	27	118		1B	76		
Vertical Wrap/Auto Page Off							
ESC w	27	119		1B	77		

Command (Parameter)					Description
ASCII	**Decimal**		**Hex**		
					one line. The top row is deleted from memory. If protection is on, the cursor will wrap from the bottom row to the top row of the **same page.** If protection is on and memory is organized as one page, it makes no difference whether Vertical Wrap/Auto Page is on or off.

4.9 KEYBOARD CONTROLS

Alarm					The terminal emits a short beep.
BEL	7		07		
Keyboard Lock					When the keyboard is locked all keystrokes which affect the display are ignored. SSET UP, SESC, NO SCROLL, SBREAK and function keys remain enabled.
ESC #	27	35	1B	23	
Keyboard Unlock					
ESC "	27	34	1B	22	
Key Click On					When key click is enabled, each keystroke is acknowledged by a short sound from the terminal speaker.
ESC >	27	62	1B	3E	
Key Click Off					
ESC <	27	60	1B	3C	
Load Function Key (p_1 p_2)					The sequence for loading a function key is:
ESC ¦	27	124	1B	7C	ESC: p_1 p_2 text string EM

Key	p_1 (ASCII) Unshifted	Shifted
F1	1	<
F2	2	=
F3	3	>
F4	4	?
F5	5	@
F6	6	A
F7	7	B
F8	8	C
F9	9	D
F10	:	E
F11	;	F

Where p_1 selects the function key to be loaded, p_2 selects the transmission mode, and the End of Medium (EM) character denotes the end of the string to be loaded.

	p_2
Transmit Only (Full Duplex)	1
Local only	2
Both (Half Duplex)	3

Note: Control codes (columns 0 and 1, Appendix A) in the text string are discarded (not loaded) unless preceded by a Data Link Escape (DLE) character.

4.9.1 Loading Function Keys. There are 256 character slots available in the function key memory pool. The terminal uses one slot for each key loaded for internal control. If only one key is loaded, it may contain up to 255 characters. If all 22 keys are loaded, a maximum total of 234 characters (256 – 22) may be loaded, distributed in any manner. Keys may be loaded in any order, and loading a new string in a key automatically cancels the previous string.

To load an ASCII control code, it must be preceded by a DLE character, which tells the terminal to accept the one character following it literally (including another DLE character or an EM character).

The second parameter in the command sequence controls how the data will be handled when the key is depressed. Transmit only (p_2 = 1) may be used in full duplex systems, with the data going to the terminal processor when echoed, or in block mode to provide a means of communicating with the host computer without affecting the display. Local only (p_2 = 2) may be used to store commands for local execution only (paragraph 3.2.8), or text to be inserted in block mode. The third mode (p_2 = 3) is provided primarily for half duplex systems; the data is transmitted and also processed by the terminal for display.

4.10 AUXILIARY PORT COMMANDS

Command (Parameter)					Description
ASCII	**Decimal**		**Hex**		
Set Aux Port Parameters (p_1 p_2 p_3)					
ESC }	27	125	1B	7D	This command overrides the switch selections for the auxiliary port baud rate, parity, word length and stop bits. The four parameters are identical to the corresponding parameters for the main port (paragraph 4.2)
Formatted Print with CR LF					
ESC P	27	80	1B	50	The contents of the current page, from home to the cursor location, are output at the auxiliary port via the print buffer. A carriage return, line feed and NUL is added at the end of each row. Spaces are substituted for all protected characters. PRT0 is displayed on the status line while the data is being output. If the terminal has more than one page of display memory the display window advances to the next page.
Page Print (Verbatim)					
ESC L	27	76	1B	4C	Same as formatted print except no substitutions are made for protected data and no CR of LF characters are added. All necessary control codes must be embedded in the data stored in the display. PRT1 is displayed while the data is being output.
Aux Port On Line,with Display					
ESC @	27	64	1B	40	All data received by the terminal is processed for display and also output at the auxiliary port via the print buffer. PRT2 is displayed on the status line while this mode is in effect. In half duplex, keyboard entries are also output.
Aux Port Off Line					
ESC A	27	65	1B	41	

Command (Parameter)					Description
ASCII	**Decimal**		**Hex**		
Aux Port On Line without Display					While the auxiliary port is on line without display, all received data is output at the auxiliary port via the print buffer, but is not processed for display. The only command that will be executed is the "Cancel" command. PRT3 is displayed while this mode is in effect.
ESC `	27	96	1B	60	
Cancel On Line without Display					
ESC a	27	97	1B	61	
Aux Port On Line Bidirectional					When the bidirectional mode is in effect, all received data is processed for display and is also coupled bit for bit to the auxiliary output without buffering by the terminal. Data received at the auxiliary port is passed to the host computer via the main port. BDIR is displayed while this mode is in effect.
DC2	18		12		
Cancel Bidirectional					
DC4	20		14		

4.11 USER/STATUS LINE COMMANDS

Load User Line					This command requires the following sequence: ESC f (up to 79 characters) CR. The user line is cleared to spares and the text following the "f" is loaded in the user line area of the terminal memory. The CR indicates the end of the text to be loaded. Video attributes may be set on the user line using the same command as for a normal line (para. 4.4). An HT character in a user line load causes the terminal to TAB to the column in the user line specified by the parameter which follows it. Parameters are the same as for cursor address (Appendix B)
ESC f	27	102	1B	66	
Display User Line					The message previously loaded is displayed in reverse video as the 25th line of the display, replacing the status line. At power up it is all spaces.
ESC g	27	103	1B	67	
Display Status Line					Restores display of the status line if it has been replaced by a displayed user line.
ESC h	27	104	1B	68	

SECTION V

INTERFACE

5.1 COMMUNICATIONS INTERFACE

5.1.1 ASCII Code. The Hazeltine Esprit III terminal communicates via the 7-bit ASCII codes shown in Appendix A. If an 8-bit character is selected (paragraph 2.2), a 0 added in the most significant bit position. If a parity bit is selected, it follows the character.

5.1.2 Asynchronous Data. The form for received and transmitted data is asynchronous serial ASCII. Each character is preceded by a start bit and separated from the following character by a minimum of 1 or 2 stop bits. Received characters must have at least 1 stop bit.

The parity bit can be selected (paragraph 2.2) to be even, odd, always one, always zero, or omitted. If a character is received with incorrect parity (with odd or even parity selected), an @ symbol is displayed on the screen at the cursor position. This indicates to the terminal operator that erroneous data was received.

Switches are provided to select 1 of 15 transmission rates from 50 to 19,200 baud.

Baud rate and character parameters selected by switches may be overridden by remote command (Section IV).

5.1.3 EIA/C.L. Input/Output Connector. The standard EIA input/output connector located on the rear of the terminal provides the connection to the appropriate data set or acoustic coupler. The signals conform to EIA Standard RS-232C for Data Terminal Equipment, and are listed in table 5–1.

The terminal generates or responds to these signals as follows:

Output: Full Duplex — Data Terminal Ready and Request to Send are always true (high).

Half Duplex — Data Terminal Ready is always true. Request to Send goes true, then false for each character.

Block — Data Terminal Ready is always true. Request to Send goes true to send, then goes false.

Local — Data Terminal Ready and Request to Send are false.

Input: If Data Set Ready or Data Carrier Detect is false, P3ER is displayed on the status line and the terminal neither transmits nor receives until the status is changed. If Clear to Send is false, transmission is suspended; receiving is not affected.

5.1.4 Current Loop. This connector also includes a 20 mA current loop interface. Connections for either active (terminal supplies current) or passive (host supplies current) current loop operation are shown in figure 5–1. These connections may be mixed (e.g., active current loop transmit, passive receive; EIA transmit, current loop receive, etc.).

5.1.5 Hardwired Interface. The terminal can be connected directly to a computer by connecting pins 2, 3, and 7 from the EIA connector on the rear panel. Note that pins 2 and 3 may have to be crossed with the corresponding pins on the computer. No wiring changes or jumpers required at the terminal to simulate the presence of a modem. Refer to your computer supplier for any special wiring at the computer interface.

5.1.6 Printer EIA Input/Output Connector. The auxiliary port permits serial communication with an RS-232C compatible auxiliary device such as a printer, recorder, or another terminal. Output and display may be controlled by the PRINT key or by remote commands as described in Section III. The interface provides the EIA RS-232C voltage level signals for Data Communication Equipment as listed in table 5–2.

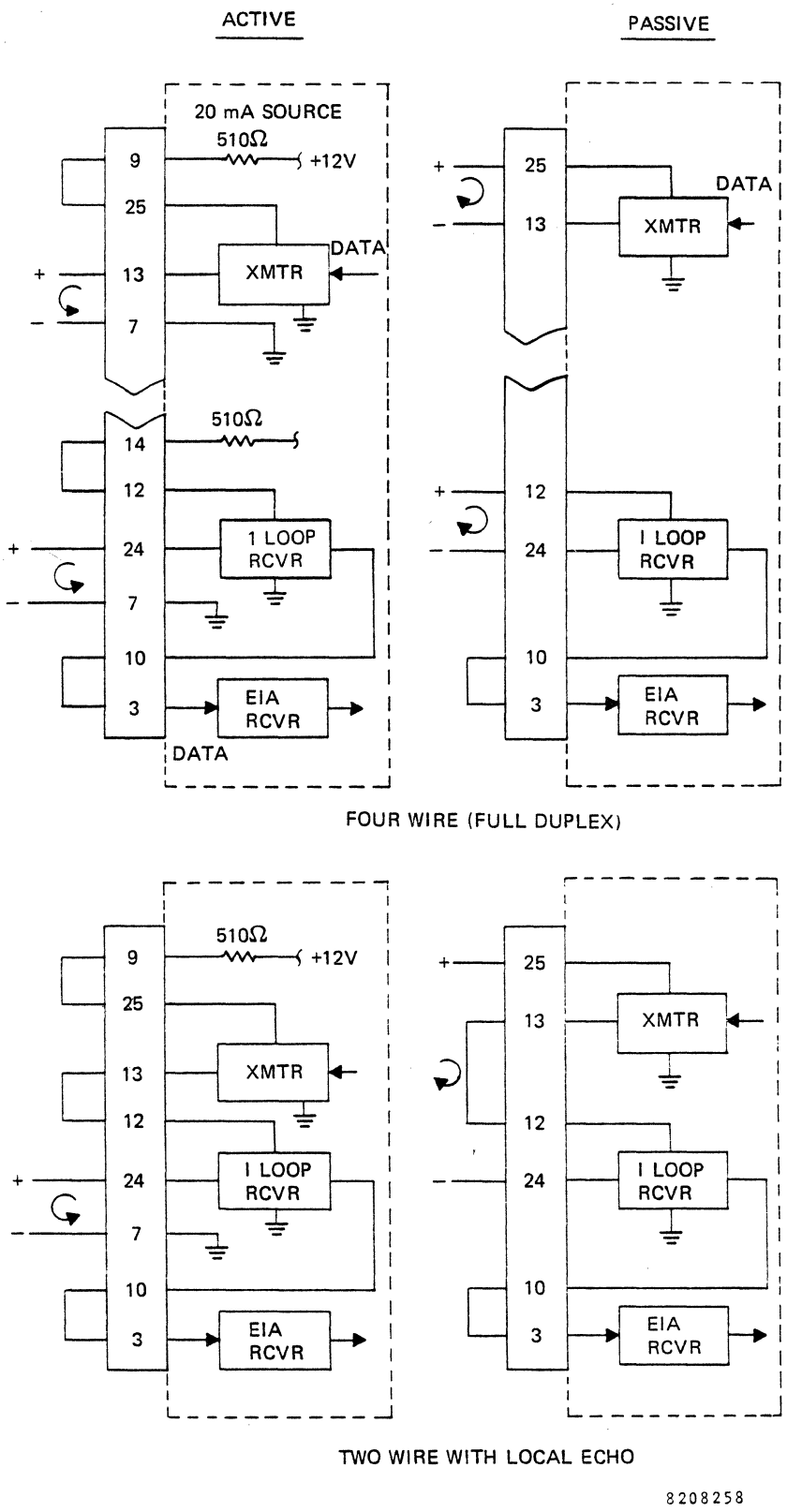


Figure 5–1. Current Loop Connections

Table 5–1. EIA/CL Interface

Pin Number	Direction of Signal	EIA Designation	CCITT Designation	Function
1	—	AA	101	Protective Ground (Chassis)
2	From Terminal	BA	103	Transmitted Data
3	To Terminal	BB	104	Received Data
4	From Terminal	CA	105	Request to Send
5	To Terminal	CB	106	Clear to Send
6	To Terminal	CC	107	Data Set Ready
7	—	AB	102	Signal Ground
8	To Terminal	CF	109	Data Carrier Detect
9	From Terminal	—	—	Current Loop Source (+12 V, no load)
14	From Terminal	—	—	Current Loop Source +12 V, no load)
10	From Terminal	—	—	Current Loop Detected Data (TTL)
12	To Terminal	—	—	+Current Loop/Receive
24	To Terminal	—	—	−Current Loop/Receive
25	From Terminal	—	—	+Current Loop/Transmit
13	From Terminal	—	—	−Current Loop/Transmit
20	From Terminal	CD	108.2	Data Terminal Ready

Table 5–2. Printer EIA Interface

Pin Number	Direction of Signal	Designation	Function
1	—	AA	Protective Ground Ground (Chassis)
2	To Terminal	Aux BB	Auxiliary Data In
3	From Terminal	Aux BA	Auxiliary Data Out
4	To Terminal	Aux CA	Auxiliary Request to Send
5	From Terminal	Aux CB	Clear to Send
6	From Terminal	Aux CC	Data Set Ready
7	—	AB	Signal Ground
8	From Terminal	Aux CF	Data Carrier Detect
20	To Terminal	Aux CD	Data Terminal Ready

Signals at pins 4 and/or 20 may be used to permit the auxiliary device to control output flow from the terminal. If either signal is low, the terminal will suspend output until it goes high (not applicable in bidirectional mode). Both signals must be high (true), or not connected, for the terminal to transmit to the auxiliary device.

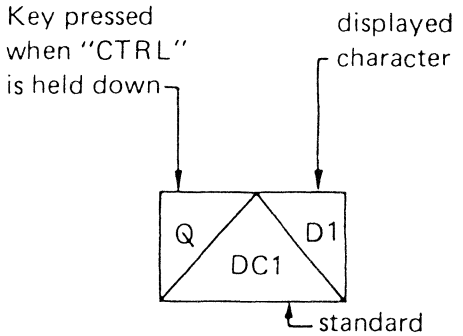
XOFF/XON protocol may also be used to control the output from the terminal. By transmitting a DC3 character to the terminal, the auxiliary device may halt output until it transmits a DC1 character. In bidirectional mode the characters will be relayed to the host computer.

APPENDIX A

ASCII CODE

ROW	BIT 4 3 2 1	COL 0 (BIT 7 6 5 = 000)	1 (001)	2 (010)	3 (011)	4 (100)	5 (101)	6 (110)	7 (111)
0	0000	@ / NUL	P / D_L DLE	SP	0	@	P	`	P
1	0001	A / S_H SOH	Q / D_1 DC1	!	1	A	Q	a	q
2	0010	B / S_X STX	R / D_2 DC2	"	2	B	R	b	r
3	0011	C / E_X ETX	S / D_3 DC3	#	3	C	S	c	s
4	0100	D / E_T EOT	T / D_4 DC4	$	4	D	T	d	t
5	0101	E / E_Q ENQ	U / N_K NAK	%	5	E	U	e	u
6	0110	F / A_K ACK	V / S_Y SYN	&	6	F	V	f	v
7	0111	G / B_L BEL	W / E_B ETB	'	7	G	W	g	w
8	1000	H / B_S BS	X / C_N CAN	(	8	H	X	h	x
9	1001	I / H_T HT	Y / E_M EM	)	9	I	Y	i	y
A	1010	J / L_F LF	Z / S_B SUB	*	:	J	Z	j	z
B	1011	K / V_T VT	[/ E_C ESC	+	;	K	[	k	{
C	1100	L / F_F FF	\ / F_S FS	,	<	L	\	l	¦
D	1101	M / C_R CR	] / G_S GS	–	=	M	]	m	}
E	1110	N / S_O SO	^ / R_S RS	.	>	N	^	n	~
F	1111	O / S_I SI	– / U_S US	/	?	O	_	o	DEL

A_K –ACKNOWLEDGE
B_L –BELL
B_S –BACKSPACE
C_N –CANCEL LINE
C_R –CARRIAGE RETURN
D_L –DATA LINK ESCAPE
D_1 –DEVICE CONTROL 1
D_2 –DEVICE CONTROL 2
D_3 –DEVICE CONTROL 3
D_4 –DEVICE CONTROL 4
E_M –END OF MEDIUM
E_Q –ENQUIRY
E_X –END OF TEXT
E_S –ESCAPE
E_B –END OF BLOCK
E_T –END OF TRANSMISSION
F_F –FORM FEED
F_S –FILE SEPARATOR
G_S –GROUP SEPARATOR
H_T –HORIZONTAL TAB
L_F –LINE FEED
N_K –NEGATIVE ACKNOWLEDGE
R_S –RECORD SEPARATOR
S_1 –SHIFT IN
S_O –SHIFT OUT
S_P –SPACE
S_H –START OF HEADING
S_T –START OF TEXT
S_B –SUBSTITUTE
S_Y –SYNCHRONOUS IDLE
U_S –UNIT SEPARATOR
V_T –VERTICAL TAB
▒ –DELETE



CONTROL CHARACTER LEGEND

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Appendix B

KEYSTROKE AND CURSOR ADDRESS CHART

The chart below lists each of the 128 ASCII characters. The second column lists the keystroke for generating the character at the terminal, where a superscript c or s indicates holding the CTRL and/or SHIFT key down while typing a character. The third column lists the row and column the cursor will go to if the character is used as the row (p_2) or column (p_3) parameter of a direct cursor address command. For the Page/Row/Column address command, the page (p_1) parameter is 0, 1, 2, or 3 for page 0, 1, 2 or 3, respectively. Any cursor address beyond the 80th column puts the cursor in column 80, and any address beyond the page limit puts the cursor on the last row of the page.

ASCII Char	Key Stroke	Row/Column Number
NUL	$^{cs}2$	
SOH	^{c}A	
STX	^{c}B	
ETX	^{c}C	
EOT	^{c}D	
ENQ	^{c}E	
ACK	^{c}F	
BEL	^{c}G	
BS	^{c}H	
HT	^{c}I	
LF	^{c}J	
VT	^{c}K	
FF	^{c}L	
CR	^{c}M	
SO	^{c}N	
SI	^{c}O	
DLE	^{c}P	
DC1	^{c}Q	
DC2	^{c}R	
DC3	^{c}S	
DC4	^{c}T	
NAK	^{c}U	
SYN	^{c}V	
ETB	^{c}W	
CAN	^{c}X	
EM	^{c}Y	
SUB	^{c}Z	
ESC	$^{c}[$	
FS	$^{c}\backslash$	
GS	$^{c}]$	
RS	$^{cs}\sim$	
US	^{c}DEL	
SP	SPACE	1
!	!	2
"	"	3
#	#	4
$	$	5
%	%	6
&	&	7
'	'	8
(	(	9
)	)	10
*	*	11
+	+	12
,	,	13
-	-	14
.	.	15
/	/	16
0	0	17
1	1	18
2	2	19
3	3	20
4	4	21
5	5	22
6	6	23
7	7	24
8	8	25
9	9	26
:	:	27
;	;	28
<	<	29
=	=	30
>	>	31
?	?	32
@	@	33
A	A	34
B	B	35
C	C	36
D	D	37
E	E	38
F	F	39
G	G	40
H	H	41
I	I	42
J	J	43
K	K	44
L	L	45
M	M	46

ASCII Char	Key Stroke	Row/Column Number
N	N	47
O	O	48
P	P	49
Q	Q	50
R	R	51
S	S	52
T	T	53
U	U	54
V	V	55
W	W	56
X	X	57
Y	Y	58
Z	Z	59
[	[	60
\	\	61
]	]	62
^	^	63
—	—	64
`	`	65
a	a	66
b	b	67
c	c	68
d	d	69
e	e	70
f	f	71
g	g	72
h	h	73
i	i	74
j	j	75
k	k	76
l	l	77
m	m	78
n	n	79
o	o	80
p	p	81
q	q	82
r	r	83
s	s	84
t	t	85
u	u	86
v	v	87
w	w	88
x	x	89
y	y	90
z	z	91
{	{	92
:	:	93
}	}	94
~	~	95
DEL	DEL	96

Appendix C

SUMMARY OF REMOTE COMMANDS

LEAD-IN[1]	ASCII	KEYSTROKE	DEC	HEX	FUNCTION (PARAMETER[2])	REMARKS	REF
				TRANSMISSION MODE COMMANDS			
ESC	c	C	99	63	Enter Local Mode		Para. 4.2
ESC	C	^SC	67	43	Enter Interactive Mode		
ESC	B	^SB	66	42	Enter Block Mode		
ESC	U	^SU	85	55	Enter Monitor Mode		
ESC	u or X	U or ^SX	117, 88	75, 58	Exit From Monitor Mode		
ESC	DH	^SD ^SH	68,72	44, 48	Set Half Duplex		
ESC	DF	^SD ^SF	68, 70	44, 46	Set Full Duplex	P_1 = Baud Rate	
ESC	k	K	107	6B	Edit Keys Local	P_2 = Stop Bits	
ESC	l	L	108	6C	Edit Keys Duplex	P_3 = Parity	
ESC	{	{	123	7B	Set Main Port Parameters (P_1 P_2 P_3 P_4)	P_4 = Word Length	Page C-4
				CURSOR AND PAGE CONTROL COMMANDS			
ESC	.	. (period)	46	2E	Cursor Attribute (P_S)	Ps Cursor	Para. 4.3
—	RS	^Λ	30	1E	Cursor Home	0 = No Display	
—	VT	^K	11	0B	Cursor Up	1 = Blink Block	
—	SYN	^V	22	16	Cursor Down	2 = Steady Block	
—	LF	LINE FEED	10	0A	Line Feed	3 = Blink U/L	
ESC	j	J	106	6A	Reverse Line Feed	4 = Steady U/L	
—	CR	RETURN	13	0D	Carriage Return		
—	US	^DEL	31	1F	New Line		
—	FF	^L	12	0C	Cursor Right		
—	BS	BACKSPACE	8	08	Cursor Left		
ESC	i	I	105	69	Tab	Address	
—	HT	TAB	9	09	Tab	P_1 = Page	
ESC	I	^SI	73	49	Back Tab	P_2 = Row	
ESC	1	1	49	31	Set Tab Stop	P_3 = Column	
ESC	2	2	50	32	Clear Tab Stop		
ESC	3	3	51	33	Clear All Tab Stops	(Appendix B)	
ESC	-	- (hyphen)	45	2D	Cursor Address (P_1 P_2 P_3)		
ESC	=	=	61	3D	Cursor Address (P_2P_3)		
ESC	?	?	63	3F	Read Cursor Addr Row/Column		
ESC	/	/	47	2F	Read Cursor Addr Pg/Row/Col	Ps Page	
ESC	\	\	92	5C	Set Page Size (P_S)	1 24 Line	
ESC	K	^SK	75	48	Advance Page	2 48 Line	
ESC	J	^SJ	74	4A	Back Page	3 96 Line	

LEAD-IN[1]	ASCII	KEYSTROKE	DEC	HEX	FUNCTION (PARAMETER[2])	REMARKS	REF
					VIDEO CONTROLS		
ESC	G	SG	71	47	Video Attribute (P_S)		Para. 4.4
ESC	)	S)	41	29	Half Intensity On	P_S ASCII / Attrib	
ESC	(	S(	40	28	Half Intensity Off	0 = Green	
ESC	$	S$	36	24	Graphics On	1 = Blue	
ESC	%	S%	37	25	Graphics Off	2 = Red	
ESC	b	B	98	62	Reverse Video	4 = Reverse	
ESC	d	D	100	64	Normal Video	8 = Minus Green	
ESC	o	O	111	6F	Blank Display		
ESC	n	N	110	6E	Restore Display		
					EDITING COMMANDS		
ESC	N	SN	78	4E	Page Edit		Para. 4.5
ESC	O	O	79	4F	Line Edit		
ESC	q	Q	113	71	Insert Mode On		
ESC	r	R	114	72	Insert Mode Off		
ESC	Q	SQ	81	51	Insert Character		
ESC	W	SW	87	57	Delete Character		
ESC	E	SE	69	45	Insert Line		
ESC	R	SR	82	52	Delete Line		
					CLEAR COMMANDS		
ESC	e	E	101	65	Load Substitute for Space (P_S)		Para. 4.6
ESC	*	S*	42	2A	Clear All to Null		
ESC	:	:	58	3A	Clear Unprotected to Null		
ESC	y	Y	121	79	Clear End of Page to Null		
ESC	t	T	116	74	Clear End of Line to Null		
—	SUB	CZ	26	1A	Clear Unprotected		
ESC	+ or ;	+ or ;	43,59	2B, 3B	Clear Unprotected		
ESC	Y	SY	89	59	Clear to End of Page		
ESC	T	ST	84	54	Clear to End of Line		
ESC	,	(comma)	44	2C	Clear Unpro to Half Intensity		

FIELD ATTRIBUTE PARAMETERS

P_S ASCII	P_S Decimal	Hex	Attribute	P_S ASCII	P_S Decimal	Hex	Attribute
0	48	30	Green	8	56	38	Black
1	49	31	Cyan	9	57	39	Blue
2	50	32	Yellow	:	58	3A	Red
3	51	33	White	;	59	3B	Magenta
4	52	34	Green, Reverse	<	60	3C	Black, Reverse
5	53	35	Cyan, Reverse	=	61	3D	Blue, Reverse
6	54	36	Yellow, Reverse	>	62	3E	Red, Reverse
7	55	37	White, Reverse	?	63	3F	Magenta, Reverse

LEAD-IN[1]	ASCII	KEYSTROKE	DEC	HEX	FUNCTION (PARAMETER[2])	REMARKS	REF
					SEND COMMANDS		Para.
ESC	7	7	55	37	Send Page (All)	P1 Key	4.7
ESC	6	6	54	36	Send Line (All)	0 = SSEND	
ESC	s	S	115	73	Send Block (All)	1 = SEND	
ESC	5	5	53	35	Send Page (unprotected)		
ESC	4	4	52	34	Send Line (unprotected)	Ps Delimiter	
ESC	S	SS	83	53	Send Block (unprotected)	0 = Field	
ESC	&	S&	38	26	Protect Mode On	1 = Line	
ESC	'	(apostrophe)	39	27	Protect Mode Off	2 = Start Prot.	
ESC	0	0	48	30	Program SEND Keu (P_1 P_2)	3 = End Prot.	
ESC	x	X	120	78	Program Delimiter (P_S P_1 P_2)	4 = End Text	
ESC	M	SM	77	4D	Transmit Terminal ID		
ESC	Z	SZ	90	5A	Transmit User/Status Line (P_S)	Ps Line 0 = User 1 = Status	
					SCROLLING CONTROLS		Para.
ESC	8	8	56	38	Smooth Scroll On		4.8
ESC	9	9	57	39	Jump Scroll On		
ESC	! 1	! 1	33, 49	21, 31	Lock Line		
ESC	! 2	! 2	33, 50	21, 32	Cancel Line Lock		
—	SI	CO	15	0F	Enable X OFF/X ON		
—	SO	CN	14	0E	Disable X OFF/X ON		
ESC	v	V	118	76	Vertical Wrap/Auto Page On		
ESC	w	W	119	77	Vertical Wrap/Auto Page Off		
					KEYBOARD CONTROLS		Para.
—	BEL	CG	7	07	Alarm	P2 Mode	4.9
ESC	#	S#	35	23	Keyboard Lock	1 Xmit	
ESC	"	S"	34	22	Keyboard Unlock	2 Local	
ESC	>	S>	62	3E	Key Click On	3 Both	
ESC	<	S<	60	3C	Key Click Off		
ESC	¦	S¦	124	7C	Load Function Key (P_1 P_2)	P1 (ASCII)	
—	EM	CY	25	19	End of F Key load	Key Unshifted Shifted	
—	DLE	Cp	16	10	Accept Control Code in F Key	F1 1 <	
						F2 2 =	
						F3 3 >	
						F4 4 ?	
						F5 5 @	
						F6 6 A	
						F7 7 B	
						F8 8 C	
						F9 9 D	
						F10 : E	
						F11 ; F	

LEAD-IN[1]	ASCII	KEYSTROKE	DEC	HEX	FUNCTION (PARAMETER[2])	REMARKS	REF
					AUXILIARY PORT COMMANDS		
ESC	}	s}	125	7D	Set Aux Port Parameters (P_1 P_2 P_3 P_4)		Para. 4.10
ESC	P	sP	80	50	Page Print with CR LF		
ESC	L	sL	76	4C	Page Print (Verbatim)		
ESC	@	s@	64	40	Aux Port on Line with Display		
ESC	A	sA	65	41	Aux Port Off Line		
ESC	`	(accent)	96	60	Aux On Line/No Display		
ESC	a	A	97	61	Cancel On Line/No Display		
—	DC2	cR	18	12	Aux Port On/Bidirectional		
—	DC4	cT	20	14	Cancel Bidirectional		
					USER/STATUS LINE COMMANDS		
ESC	g	G	103	67	Display User Line		Para. 4.11
ESC	h	H	104	68	Display Status Line		
ESC	f	F	102	66	Load User Line		
—	CR	RETURN	13	0D	End of User Line Load		

PORT PARAMETERS

P1

ASCII	Dec	Hex	Baud Rate
0	48	30	9,600
1	49	31	50
2	50	32	75
3	51	33	110
4	52	34	135
5	53	35	150
6	54	36	300
7	55	37	600
8	56	38	1,200
9	57	39	1,800
:	58	3A	2,400
;	59	3B	3,600
<	60	3C	4,800
=	61	3D	7.200
>	62	3E	9,600
?	63	3F	19,200

P2

ASCII	Dec	Hex	No of Stop Bits
0	48	30	1
1	49	31	2

P3

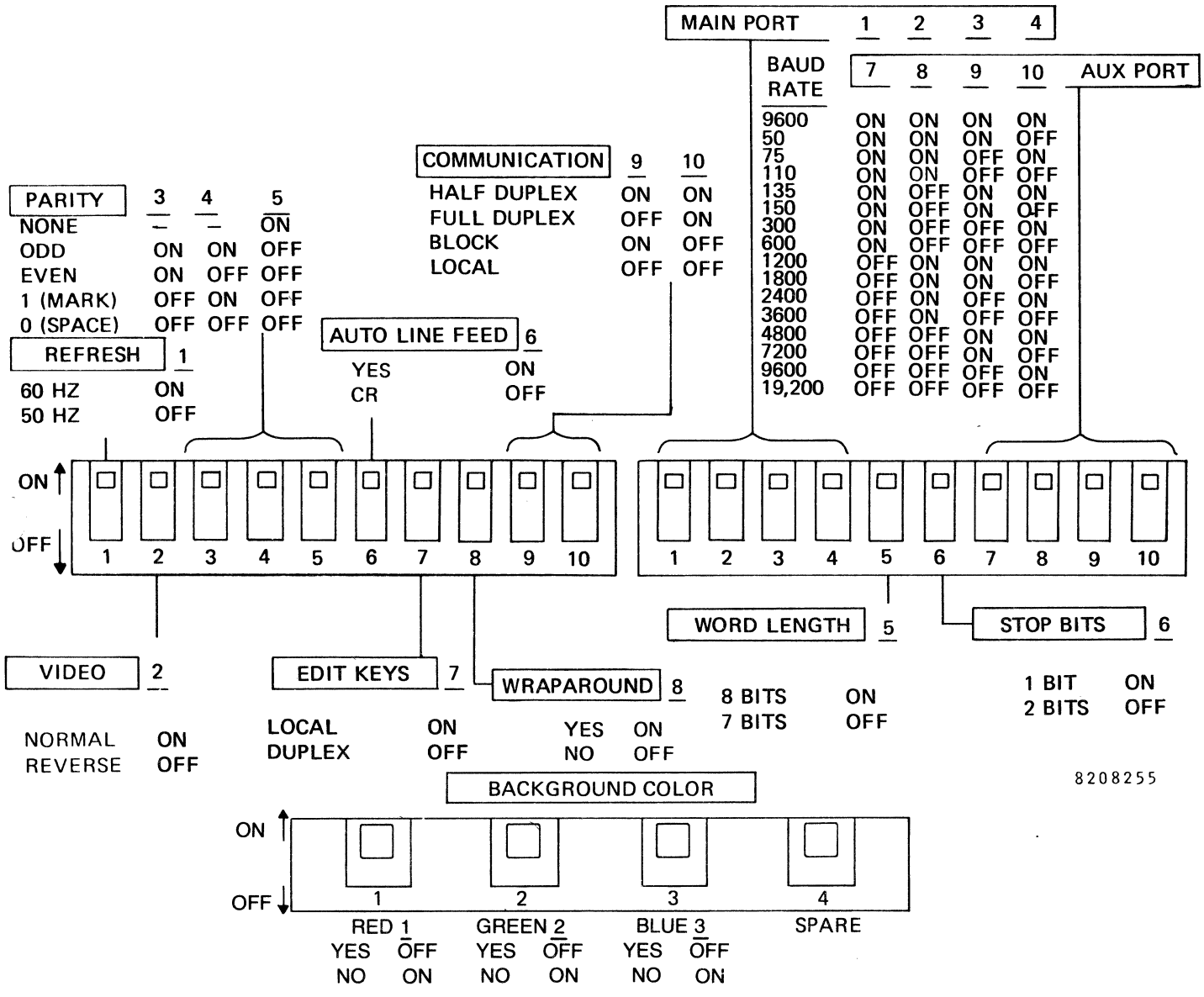
ASCII	Dec	Hex	Parity
0	48	30	None
1	49	31	Odd
3	51	33	Even
5	53	35	Mark (One)
7	55	37	Space (Zero)

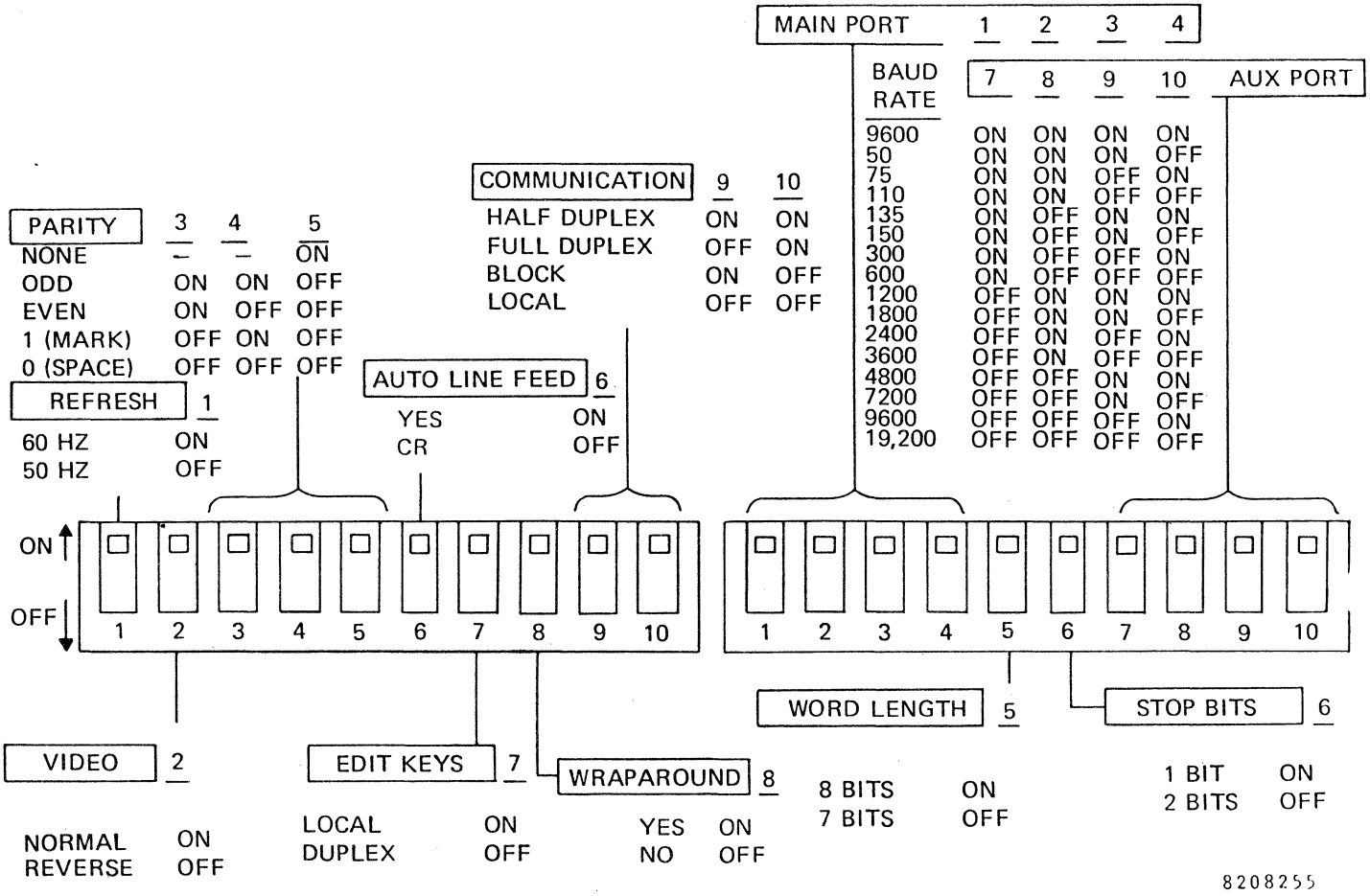
P4

ASCII	Dec	Hex	Word Length
0	48	30	8 bits
1	49	31	7 bits

[1] Lead-In = ASCII ESCAPE, Decimal 27, Hex 1B

[2] Each parameter is a single ASCII character and must follow the command without intervening characters.


MAIN PORT 1 2 3 4
BAUD RATE
7 8 9 10 AUX PORT
9600 ON ON ON ON
50 ON ON ON OFF
75 ON ON OFF ON
110 ON ON OFF OFF
135 ON OFF ON ON
150 ON OFF ON OFF
300 ON OFF OFF ON
600 ON OFF OFF OFF
1200 OFF ON ON ON
1800 OFF ON ON OFF
2400 OFF ON OFF ON
3600 OFF ON OFF OFF
4800 OFF OFF ON ON
7200 OFF OFF ON OFF
9600 OFF OFF OFF ON
19,200 OFF OFF OFF OFF
COMMUNICATION 9 10
HALF DUPLEX ON ON
FULL DUPLEX OFF ON
BLOCK ON OFF
LOCAL OFF OFF
PARITY 3 4 5
NONE — — ON
ODD ON ON OFF
EVEN ON OFF OFF
1 (MARK) OFF ON OFF
0 (SPACE) OFF OFF OFF
REFRESH 1
60 HZ ON
50 HZ OFF
AUTO LINE FEED 6
YES CR ON
OFF
ON
OFF
1 2 3 4 5 6 7 8 9 10
1 2 3 4 5 6 7 8 9 10
WORD LENGTH 5
STOP BITS 6
8 BITS ON
7 BITS OFF
1 BIT ON
2 BITS OFF
VIDEO 2
NORMAL ON
REVERSE OFF
EDIT KEYS 7
LOCAL DUPLEX ON
OFF
WRAPAROUND 8
YES ON
NO OFF
BACKGROUND COLOR
ON
OFF
1 2 3 4
RED 1 YES ON NO OFF
GREEN 2 YES ON NO OFF
BLUE 3 YES ON NO OFF
SPARE
8208255


MAIN PORT 1 2 3 4
BAUD RATE
7 8 9 10 AUX PORT
9600 ON ON ON ON
50 ON ON ON OFF
75 ON ON OFF ON
110 ON ON OFF OFF
135 ON OFF ON ON
150 ON OFF ON OFF
300 ON OFF OFF ON
600 ON OFF OFF OFF
1200 OFF ON ON ON
1800 OFF ON ON OFF
2400 OFF ON OFF ON
3600 OFF ON OFF OFF
4800 OFF OFF ON ON
7200 OFF OFF ON OFF
9600 OFF OFF OFF ON
19,200 OFF OFF OFF OFF
COMMUNICATION 9 10
HALF DUPLEX ON ON
FULL DUPLEX OFF ON
BLOCK ON OFF
LOCAL OFF OFF
PARITY 3 4 5
NONE — — ON
ODD ON ON OFF
EVEN ON OFF OFF
1 (MARK) OFF ON OFF
0 (SPACE) OFF OFF OFF
REFRESH 1
60 HZ ON
50 HZ OFF
AUTO LINE FEED 6
YES ON
CR OFF
ON
OFF
1 2 3 4 5 6 7 8 9 10
1 2 3 4 5 6 7 8 9 10
WORD LENGTH 5
STOP BITS 6
8 BITS ON
7 BITS OFF
1 BIT ON
2 BITS OFF
VIDEO 2
NORMAL ON
REVERSE OFF
EDIT KEYS 7
LOCAL ON
DUPLEX OFF
WRAPAROUND 8
YES ON
NO OFF
8208255

100 MARCUS DRIVE
MELVILLE, NY 11747